DECEMBER 1, 1958 PRICE 50 CENTS

RESEARCH and DEVELOPMENT news issue

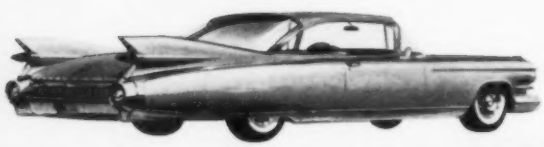
Product Engineering

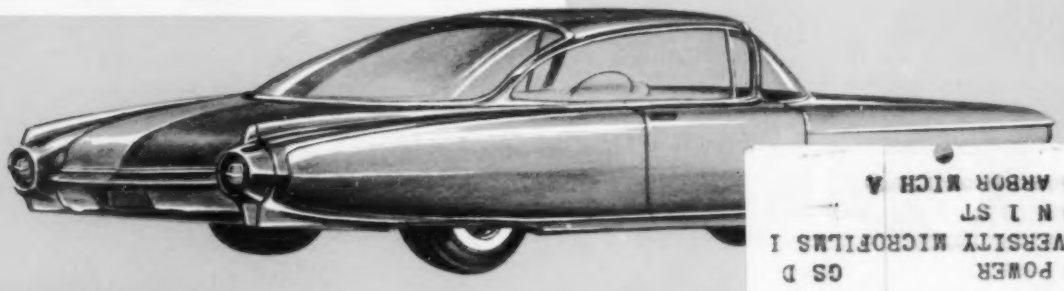
McGRAW-HILL MAGAZINE OF DESIGN
RESEARCH AND DEVELOPMENT

EIGHT DESIGN AUTHORITIES...

- **EDGAR KAUFMAN** • author, design consultant
- **ROBERT KOLLI** • professor, industrial design, Pratt Institute
- **RAYMOND LOEWY** • industrial designer
- **LAWRENCE E. MOREHOUSE** • director, Human Performance Lab, UCLA
- **DINO OLIVETTI** • president, Olivetti Corp. of America
- **BROOK STEVENS** • industrial designer
- **SUNDBERG-FERAR** • industrial designers
- **WALTER DORWIN TEAGUE** • industrial designer

...EVALUATE '59 CARS





For details on these sketch-pad comments on the '59 DeSoto (above) and Cadillac (below), see flap inside cover.

For other evaluations, pro and con, see pages 26-29.

E B POWER GS D
UNIVERSITY MICROFILMS I
313 N 1 ST
ANN ARBOR MICH A

Optics Mfg. offers lifetime guarantee for projector case made of MARLEX*

"We picked MARLEX for our new slide projector case and height adjustment knob because it is the least expensive type of plastic material that has the required rigidity, resistance to heat and impact, colorability and gloss," says Herbert R. Leopold, Vice President of Optics Manufacturing Corp., Philadelphia, Pa.

"Our new Opta-Vue is the first projector on the market with a thermoplastic housing. Since this was a design innovation, we had to be sure to select a suitable resin, so we tested them all. One "high-impact" plastic lasted just 4 hours in our heat test before it melted! Another "heat-resistant" plastic cracked in several places in our drop test. MARLEX was the only material tested that matched all our specifications and passed all our tests. In fact, we advertise a lifetime guarantee for all MARLEX projector components!"

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THEN CAME THE NEW MODELS

In this issue, **"POINTS OF VIEW"** and **"TRENDS in appearance design,"** two exclusive **Product Engineering** departments, are combined to bring you pros and cons of the new cars. This is another in our series of thought-provoking controversies. Earlier ones: Patents (Sept. 22 p 38), Inventions (Feb. 24 p 32 & June 2 p 26), Engineering Unions (Apr. 21 p 36).

One panel member, Raymond Loewy, preferred to comment with sketch pad. The results are on our cover. The DeSoto is shortened about 14 in., side chromium decor is removed, the front of the hood is lowered slightly. Fins are minimized, and the rear-wheel housing opened. The Cadillac is 20 in. shorter, rear bumper is simplified, metal and labor in fenders and trunk are cut. These changes save money, ease parking, reduce weight, simplify appearance. They do not represent Loewy's conception of the ideal automobile for today.

coming next week . . .

the DESIGN issue

for December 8

FEATURING

- **Linkage joints—the vital machine element**
  The linkage joint is described in terms of joint form, attachment and specification.
- **A new concept in air lubrication**
  Design formulas and performance data for the rugged, inexpensive, step bearing.
- **One temperature for successive brazes**
  How tighter production control and special brazes allow multiple brazing without lowered final-assembly temperatures.
- **Designing with swivel joints**
  A straightforward approach in 3-D piping layouts to eliminate trial and error.
- **Designing for plasma-arc plating**
  New production process tames 15,000 F, forms tungsten shapes.
- **More work for the busy staple**
  Design is putting these versatile fasteners into almost everything. Here's how.
- **Stress in flat-ended pressure cylinders**
  Curves cut calculations for this recurring design problem.

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

R and D Research and Development news issue

December 1, 1958 Vol. 29, No. 49

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Product Engineering .....SIDELIGHTS

RESEARCH and DEVELOPMENT news issue

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● **Industrial designers aren't** alone by a long shot in criticizing Detroit (p. 26), but to our knowledge only Phyllis McGinley in *The New Yorker* last month mourned the redesigned Rolls-Royce. Noting that RR now advertises its cars as designed for the owner-driver, Miss McGinley cries that, without a chauffeur, "Who now will stow/the wicker hampers away? For ladies in sable/who'll spread the cloth, uncork the Veuve Clicquot?/Who'll clean/the optional-special espresso coffee machine . . .?/Gone newsboy's Grail, all that is rich and choice/and suave as David Niven./Grandeur, a long farewell. The new Rolls-Royce/is owner-driven."

● **"How much has happened in these 50 years**—a period more remarkable than any, I venture to say, in the annals of mankind. I am not thinking of the rise and fall of empires, the change of dynasties, the establishments of governments. I am thinking of those revolutions of science which have had much more effect than any political cause, which have changed the position and prospects of mankind more than all the conquests and all the codes, and all the legislators that ever lived."

—Benjamin Disraeli, 1873

● **The cartoons** illustrating the article on p. 22 were first sketched by the author on a tired Friday afternon flight home. Perhaps the noise, or the weariness, or the sensation of being far from home reminded him of a time 15 years ago when war and war equipment were our primary concern. Do you remember the little stick figures all electronic technicians used to draw on wiring diagrams? Little men perched on electron tubes, swung from transformer coils, played leapfrog over capacitor symbols and jumped from switch terminals to float gracefully down under an open umbrella. The Kilroy Era, when a smile eased the tension. . . .

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CYANAMID

PLASTICS NEWSFRONT

Midget Adding Machine New Step in Miniaturization

This telephone-size, 7½-pound adding machine, the *Add-Mate*, is Underwood Corporation's newest bid to reduce size and weight of business machines. Easily portable, it can be slipped into a desk drawer or under a counter when not needed. Contributing to its compactness and lightness is the attractive, two-toned housing of CYMAC SUPER* 201 methyl-styrene-acrylonitrile copolymer plastic.

THE COLORFUL TWO-PIECE HOUSING is molded of CYMAC SUPER. Shown above, respectively, are the complete unit, the unit minus the top section, and the inner sides of the top and bottom sections. CYMAC SUPER was selected because of its toughness, surface hardness, and resistance to heat, staining and denting. It is unaffected by the diester permanent lubricant applied to the mechanical assembly prior to encasement in the housing. The transparent, serrated tear-plate, also CYMAC SUPER, and the housing are injection-molded for Underwood by Nopco Plastics, Inc., Erie, Pa. *Trademark

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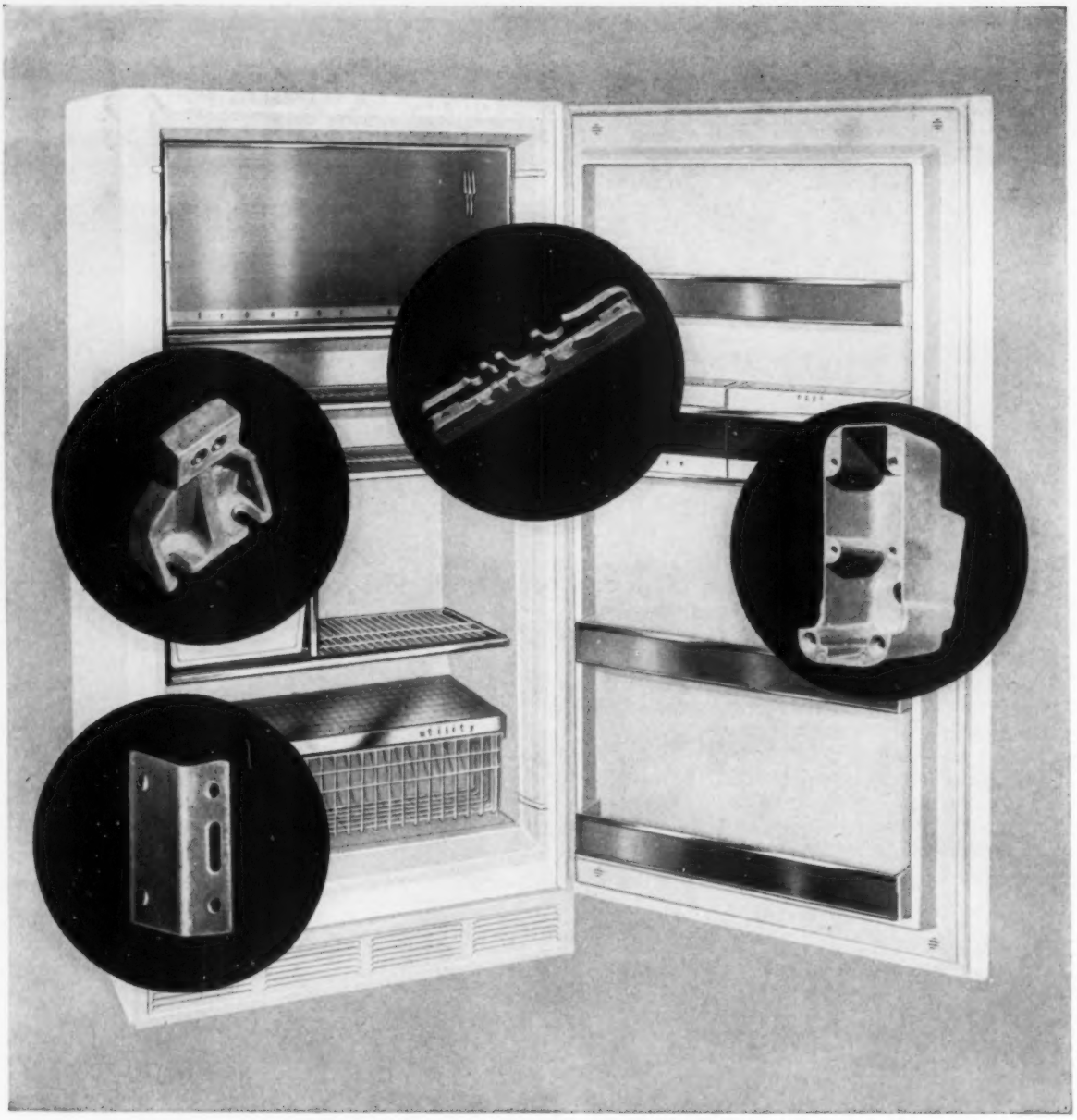


Kelvinator gets big benefits from premix moldings

Premix moldings are making an important contribution to performance of Kelvinator refrigerators.

Strike mounting plates, tie-straps, tubing retainers and lock housings for the Kelvinator are all premix moldings. They've proved tough and resilient . . . excellent shock absorbers. And their thermal insulating properties contribute to the economical operation of the refrigerator.

When resins and reinforcing fibers are blended beforehand, moldings are stronger, wall thicknesses more uniform, weak spots are eliminated. Small and large, simple and complex, premix moldings are not only improving products but cutting costs for hundreds of manufacturers.

If your product calls for strong, rigid, reinforced plastics, look into premix moldings made with Dow vinyltoluene or Dow styrene. Get the names of molders and suppliers from your nearest Dow sales office or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Dept. 2207K-2.

YOU CAN DEPEND ON DOW

American

DEVELOPMENTS TO WATCH...

The car that needs no greasing . . .

. . . may be on the road in 3 to 5 years, says W. M. Drout, Jr, manager of Marketing Economics of Esso Standard Oil Co. While no one has yet developed the ideal low-cost, long-life frictionless seal bearing, the number of chassis fittings has dropped remarkably—56% in the past 7 years. The number remains about the same for 1959 cars as for 1958, but Drout predicts it will drop steadily from 1960 on—may reach the zero point by 1963. Result, of course, will be a marked reduction in grease demand.

Photochemical windshields . . .

. . . to blot out the flash of atomic bombs may be one outgrowth of National Cash Register's work with encapsulated compounds that has already brought NCR ("no carbons required") typing paper and promises new "chemical memories" for computers.

The principle in each case is the same: Sensitive chemicals are encased in tiny capsules to be coated on paper, plastics or glass.

In the case of the NCR paper, the chemical is one which, when it comes in contact with a special clay on the under surface of the typing sheet, turns black and produces the "carbon." This is an irreversible reaction. The computer elements and the windshield, though, use light-sensitive compounds which change color in the presence of intense light, and then change back again. This would make it possible to produce a windshield that would go black at the moment of an atomic flash, but would be perfectly clear the rest of the time.

The Air Force thinks enough of the idea to have awarded NCR a development contract; and the company itself is working on a number of other ideas, including encapsulation of jet fuels so they'd be easier to handle. (For more on light-sensitive chemicals and their engineering uses see *PE*—Feb 10, p 14, and Nov 24, p 22.)

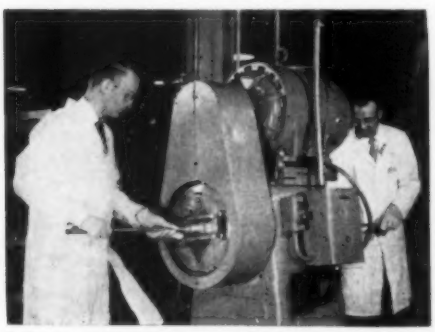
Ceramics can be swaged to shape . . .

. . . and clad with metal at the same time, say engineers at the GE-operated AEC Richland, Wash. plant. They've developed a process that does the trick, and bypasses conventional compacting and sintering.

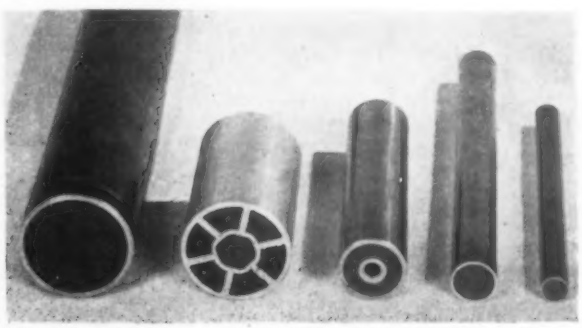
The process is surprisingly simple: ceramic powder is packed into a metal tube which is then sealed at each end by soft rubber stoppers or welded metal caps (the latter when the material is to be swaged hot). The tube is then inserted in a swaging machine (photo below, left) and reduced the desired amount.

That's all there is to it. When it comes out of the machine, the material is densely compacted and ready to go to work.

Reporting on the process to the recent Metallurgical Society meeting in Cleveland, GE engineers noted that, as expected, properties of the finished product depend to a large extent on the characteristics of the powder used. But the requirements are almost exactly the opposite of those for conventional compacting and sintering. Conventional techniques call for fine powders with large surface areas. Swaging requires large particles, low surface areas, and high bulk-packaged densities. —ARC



Rotary swager of standard design is used by GE engineers in one-step ceramic-cladding process.



Metal-clad ceramics produced by the swaging machine. Cladding materials include aluminum, stainless steel, and zirconium.

In parallel shaft drives . . . look for

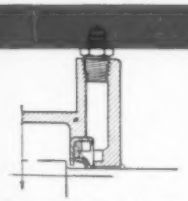
resistance to shock and overloading

You'll find it . . . and these "plus" performance features . . . when you specify LINK-BELT

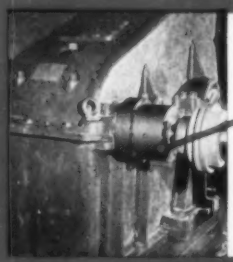
Under the shocks and overloads that are often encountered by parallel shaft gear drives, rugged housing construction is vital if shaft alignment is to be maintained. That's why Link-Belt adds special reinforcement at points of greatest stress . . . has developed this design expressly for endurance in heavy-duty service.

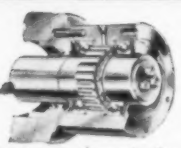
Write for your copy of Book 2619 on this broad line with ratios to more than 300:1. Or get first-hand information from your nearest Link-Belt office.

Automatic splash lubrication reliably supplies oil to all gears and bearings.



Grease-lubricated seals on all input and output shafts prevent entrance of dirt, water.





Backstop automatically prevents reverse rotation of output shaft due to power stoppage or other causes.

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DEVELOPMENTS TO WATCH...

Look for Congress to revamp patent provisions . . .

in the Space Act of 1958 that established the new National Aeronautics and Space Administration.

Industry claims that patents section of the new act is unduly restrictive, and is plugging to get it rewritten.

As it stands now, virtually all inventions made in the performance of work for the NASA become exclusive property of the government. The situation applies down to the subcontractor level even though the subcontractor is unaware that his invention may have any relation at all to the new NASA.

The patent restrictions go further. Industry claims the new act makes it necessary for any person making an invention that can be used in space activities to declare under oath that the work was not related to any NASA contract before a patent can be obtained.

What industry wants is to bring the NASA patent regulations in line with Dept of Defense rules where a company retains the title to an invention, with the government holding license rights.

Test firings of dummy Polaris missiles . . .

will start within the next week or so from the Navy's observation-island test ship—a converted merchant ship.

Actual Polaris firings will be made early next year from the ship. More test-vehicle firings are slated from Cape Canaveral before the end of this year. So far, 25 test-vehicle firings of the Polaris have been made. Reports are that only a few more such test shots will be made before the completed missile is stacked together and fired.

The Navy is still trying to find the ideal motor casing construction for the weapon. Reportedly the welded steel jackets used in the past are not entirely satisfactory. Navy admits it has almost a "dozen" approaches to the problem under study; one spiral-wrapped construction and titanium alloys.

Don't be stirred up too much . . .

over status of the nation's missile program. Congress is sure to take a look into it this coming session. But that is an annual ritual.

Observers don't foresee any major developments from the much-publicized Air Force-General Accounting Office squabble over an internal report on the Air Force missile program. Nor do they see any spectacular changes coming from Army's plea for a 5-year program to modernize its forces.

By and large, the experts claim the missile program will go along pretty much as now. Production of the IRBM Thor and Jupiter missiles may be scaled down some. But that's about all the cutting back expected.

Armed forces have 82 new technical problems . . .

they are calling on industry to solve. These range from problems in aeronautics, missiles and space to metallurgy and metal fabrication.

As in the past, a complete list of the problems can be had free from The National Inventors Council, US Dept of Commerce, Washington DC.

Published as a supplement to a standing list of some 300 inventions wanted, the new announcement answers a list of questions most asked by companies that come to the government with a proposal. Included are such items as patent protection and payment for an invention.

Research activities of the Federal government . . .

are listed in an 11-page document that shows which of its agencies are doing work in the various fields of research, propulsion, fluid mechanics, etc. Then, it has a detailed rundown on each agency's research operations, with specific offices to contact where additional information can be obtained.

Cost of the document, titled "Federal Agencies Financing Research," is $1. It is available from the Social Legislation Information Service Inc, 1346 Connecticut Ave, NW, Washington. Such a listing has been in demand, especially for smaller companies, for a long time.

World-wide ...

DEVELOPMENTS TO WATCH...

A transparent film of gold . . .

. . . serves as the windshield de-icing mechanism in a new glazing system developed by Triplex Safety Glass Co Ltd, King's Norton, Birmingham 30, England. The gold, in a vacuum-deposited layer only 0.0000002 in. thick, is said to be perfectly clear, though slightly yellow in color, and to absorb little more than 5% of the light it receives. Yet, the company claims, it is capable of carrying up to 1000 watts/sq in.

Total glass thickness is $\frac{5}{16}$ in. in larger sizes, $\frac{1}{4}$ in. in smaller sizes. Maximum dimensions are 30 by 42 in., and the normal operating voltage is 24 to 240.

For lower-voltage applications, the company also has new wire-mesh units in which extremely fine wires (invisible in daylight, though they do tend to diffract point sources of light at night) are laminated between two layers of glass. These will operate from a 12-v power source and are "therefore very suitable for motor cars and other passenger vehicles."

Power requirement for auto and refrigerator windows is estimated at 30-36 watts/sq ft; for earth-moving machinery and locomotives, 50 to 80.

Sandhopter car . . .

. . . has been developed by engineers at Tarim Oilfield Administration in Sinkiang province, China. "Sandhopter" is not what they call it, but it's a motor car specifically designed for desert use ("takes the place of camels"), and it has a propeller in front, the Red Chinese say. Also featured: double tie-rods on the front wheels and caterpillar-type tracks on the rear end of the car.

Conversion coatings on sheet iron . . .

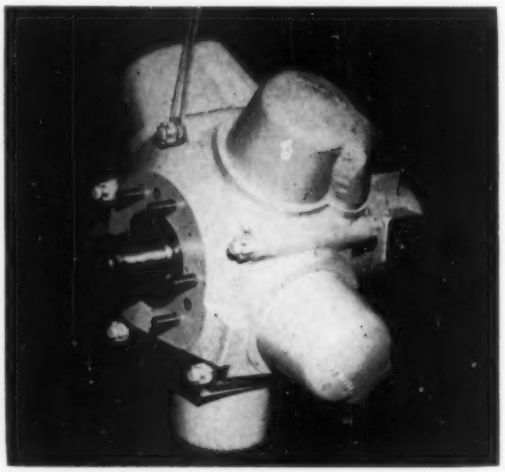
. . . can replace paper and enamel insulation, Soviet engineers claim. They say they've found a simple method for producing ferroferric oxide films on sheet iron (by annealing at 1070 F in air) that produces a material suitable for use in dynamos and other electrical equipment at a cost only 10% of conventional insulations. Furthermore, they note, the coating is magnetic. (Chemically, it's similar to magnetite.)

New hydraulic motor . . .

. . . designed in England, is a slow-speed, high-torque unit said to be able to maintain constant torque at any speed from 0 to 50 rpm in either direction when operated by a variable-delivery pump. Output capacity is 3500 ft-lb torque. Built for use on mixers, hoists, capstans, and conveyors, it's said to be adaptable for automatic or remote control, and to permit eliminating the braking mechanism in many applications.

Chamberlain Industries Ltd, Staffa Works, Leyton, London, E 10, which developed it, says it's less expensive than comparable units and considerably easier to maintain. Chamberlain also notes that, under test, the unit has proved its ability to operate at twice its rated maximum, and considerably above the top recommended pressure (1500 psi).

The crankcase is split around its periphery to facilitate assembly, and the cylinder heads are clamped between the two sides of the case. —ARG



High-torque motor has five radially mounted cylinders, a pintle-type valve, and tapered-roller crankshaft bearings. Cylinder bore is 4 in., stroke 3 in.

Design for full production efficiency: Continuous-Cast Bronze Castings.

Lower material costs, faster production, better products. Certainly a powerful set of reasons for evaluating Asarco's unique process of casting shapes in continuous lengths. The alloys produced by continuous casting are in accord with SAE, ASTM, and government specifications but their performance is demonstrably superior to similar alloys cast other ways. So superior in hardness, tensile, yield, and impact strength, that you may be able to substitute an Asarcon bronze for a high-cost aluminum or manganese bronze. You get the shape you need in the exact lengths you need, with minimum clean-up necessary, machinable on high speed machines. Immediately available in 260 *stock* sizes: Asarcon 773 (SAE 660) Bearing Bronze, solids and tubes, in lengths up to 105 inches. Write today for free booklet on Asarco continuous-casting to Continuous-Cast Products Department, American Smelting and Refining Company, Barber, N. J.; on the West Coast, Kingwell Bros., Ltd., 457 Minna St., San Francisco; in Canada, Federated Metals Canada, Ltd., Toronto and Montreal.

CONTINUOUS-CAST DEPARTMENT OF

ASARCO

AMERICAN SMELTING AND REFINING COMPANY

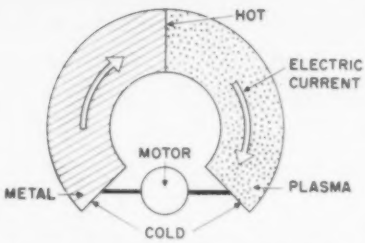
CIRCLE 54 READER SERVICE CARD

What's happening in SCIENCE

New route to thermoelectricity

A "thermocouple" that uses only one metal and has no moving parts has been built at Los Alamos Scientific Laboratory as first step in development of a thermoelectric generator that will permit large-scale, economical conversion of nuclear to electrical energy.

The new "plasma thermocouple" differs from conventional units in that the second metal normally present is replaced by a plasma—a hot, ionized, electrically conductive gas (*PE—Oct 7 '57, p 15*). The device is not quite as simple as the diagram would indicate, though. It's a real job to create and confine the plasma, and make the electrical contacts. But an experimental unit has been built that does work; and, says Los Alamos, it has a "driving force" 1000 times greater than that of the standard metal type.



Plasma thermocouple, here shown in vastly simplified schematic, is basically similar to standard bimetal unit.

Project names for the atom

You can't get to the moon, build a ship, or put the atom to work these days without a proper label for your project; and, with everybody doing it, the labels are getting mighty confusing. Here, though, are a few that are worth knowing because they're official Atomic Energy Commission designations, and they're likely to be around for quite a while:

SHERWOOD: The over-all name for the Controlled Thermonuclear Research program—the effort to "tame the H-bomb."

PLOWSHARE: The peaceful use of nuclear explosives—untamed, but put to such jobs as blasting, flood control, production of power and radioisotopes.

PLUTO: Application of nuclear energy to ramjet propulsion.

ROVER: Application of nuclear energy to rocket propulsion.

SNAP: Use of nuclear energy as a source of auxiliary power for space satellites.

briefs . . .

Space Age background is provided by "Proceedings of the Seventh Agard General Assembly," just released by the National Advisory Committee for Aeronautics. It's "background" rather than news because the long delay in publication (the conference was held a year ago) means the papers are a little behind the times. Nevertheless, there is much useful data on propulsion systems, aerodynamics, and human engineering. Single copies of the 102-page publication are free from NACA, Washington 25, DC.

Lower-boiling fuels cause less knock than higher-boiling fractions, a Phillips Petroleum-Ethyl Corp study indicates.

Two gasolines having the same Research and Motor octane numbers and the same over-all hydrocarbon composition may still differ significantly in road antiknock performance; and boiling range of the specific hydrocarbon types represented appears to be one of the culprits.

The study shows that olefins boiling at less than 210 F give better road performance at all engine speeds than do those boiling above 300 F. Aromatics in the lower range also do better at low speeds, though there seems to be no great difference here at higher speeds.

High-purity hydrogen for lab use can be made from commercial gas with a new palladium purifier being introduced by Englehard Industries. The initial unit, designed for a flow rate of 20 cu ft an hr, operates at 570 F, uses 100 watts of power. —ARG

Test that shoots the works

A crossbow made from an automobile spring and a steel cable is helping Stanford Research Institute find out what would happen if a nuclear reactor really "blew."

The problem, posed by the AEC: How much shielding would be needed to keep heavy reactor control-rods from doing physical damage to the reactor housing (and personnel) if a reactor should run away?

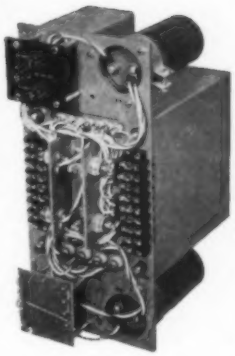
Why the crossbow? Says SRI: The principle of the crossbow makes possible close control of the velocities of the rods. As a matter of fact, SRI researchers are using a real crossbow for small-scale tests; the one pictured here for medium-sized rods; and the guns shown in the background for heavy-duty work.

Crossbow projects rods at controlled velocities.

CEC announces the new DataTape digital magnetic tape recorder/reproducer

- *all transistorized electronics*
- *modular construction**
- *starts and stops in less than 5 milliseconds*
- *high-speed servo response*
- *continuous-duty servo motors*
- *all-metal-surface magnetic heads*
  (½" SPACING BETWEEN READ AND WRITE HEADS)
- *uses ½" to 1¼" tape*
- *10½" reels with NARTB hubs*
- *designed for standard rack mounting*
- *size: 19" wide by 24½" high by 13" deep*

NOW AVAILABLE... Not merely a laboratory instrument, but a fully ruggedized, reliable digital recorder designed for a whole gamut of industrial applications where long periods of unattended operation with minimum maintenance and down-time are paramount. Standardized speeds, track-width and spacing, and start and stop distances assure complete compatibility with other digital tape transports and handlers. *Contact your nearby CEC field office for complete information,* or write for Bulletin CEC 1608-X15.



**Modularized components, such as Power Supply Unit at right, permit instant access and easy maintenance or replacement with minimum down-time.*

DataTape Division

Consolidated Electrodynamics

300 North Sierra Madre Villa, Pasadena, California

OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

What's happening in MATERIALS

Tinned castings better, cheaper

On Meehanite and nodular cast iron, an improved "direct-chloride" tinning process can provide better corrosion protection at lower cost than any methods previously available, says Britain's Tin Research Institute.

This process, first announced about three years ago, is now moving into commercial use, and field reports indicate it can do an excellent job, when properly applied, of protecting cast-iron parts—pumps, valves, feed screws—for food-handling equipment and other machinery subject to highly corrosive conditions.

Direct-chloride is an outgrowth of the "fused salt" technique developed during World War II, but instead of requiring a separate salt bath before tinning, it simply calls for a salt flux layer floating on the surface of the molten tin. It does, however, require careful casting preparation. Blasting with fine grit before tinning is an essential step.

Surprisingly, the process not only does a good job on such special irons as Meehanite and the nodular types, but actually seems better suited for them than for ordinary gray iron—apparently because of the way carbon is held in these materials. Free carbon at the casting surface appears to interfere with adhesion and continuity of the tin coating.

The process is not, however, especially recommended for use on bearing surfaces since adhesion of white metal to parts tinned this way is not outstanding (bond strength averages about 2.3 tons/sq in.). But it does seem adequate for many applications. Best results are obtained when high-tin bearing alloys are used.

New data on gases and liquids that carry heat

Facts and figures on heat-transfer media, standard as well as special, are coming in abundance from the atomic-energy field.

Cooling nuclear reactors is a king-sized problem, and reactor-builders are trying all sorts of approaches. Some involve specialized materials, of course—heavy water, for instance. But others take advantage of, and improve on, systems and materials already available to industry; including air, water, diphenyl compounds, carbon dioxide, superheated steam, molten salts, liquid sodium, and sodium-potassium compounds.

Many reports on AEC-sponsored heat-transfer media research are now obtainable from the Office of Technical Services; a good deal of this information is summarized in the AEC's quarterly technical progress reviews (*PE—Aug 11, p 10*). Much information was released at the Geneva Conference (*PE—Oct 6, p 10*); and is now being made available not only by the government; but also by industrial firms and research laboratories—among them, Dow, Monsanto, Battelle Memorial Institute.

briefs . . .

Conductor slide rule to simplify conversions from copper windings to aluminum strip has been designed by Alcoa engineers; is being made available free of charge through the company's sales office. Frankly aimed at encouraging use of the company's new 3EC alloy, available in thicknesses from 0.00025 in. and widths to 60 in., the rule also permits conversions from aluminum wire to strip. In addition, it gives resistance in ohms/1000 ft at room temperature and weight in lb/1000 ft. (For more on aluminum conductors, *PE—May 19, p 12.*)

Metal fibers for use as fillers in molded plastics and in the manufacture of abrasives and friction materials are being produced by a new shaving process developed by G. H. Tennant Co, Minneapolis 22. Like the other fine-diameter metal fibers now commercially available, these may also prove useful in making electrically conductive papers, filters, and a variety of products for high-temperature use.

High-strength magnet wire is offered by Secon Metals Corp, White Plains, N.Y. Nearly twice as strong as copper, it's said to have a specific resistance "only slightly higher" than that of the pure metal (12.11 ohms for the bare wire), can be made in sizes down to 0.0004 in.

Nonmagnetic casting alloys with high tensile strength are being sought by Naval Research Laboratory. Minesweeper applications are the primary aim, but the work is basic enough to have broader significance.

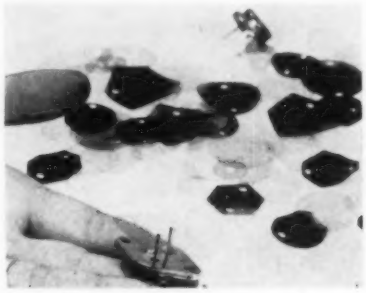
Austenitic steels, says NRL, while nonmagnetic, have a relatively low yield strength. On the other hand, high chrome-nickel alloys and manganese-vanadium alloys containing little chrome or nickel can be heat-treated to high hardness; but are too brittle for use.

NRL is continuing a two-pronged attack: investigation of other compositions, and development of new heat-treating methods to improve ductility of the ones already tested.

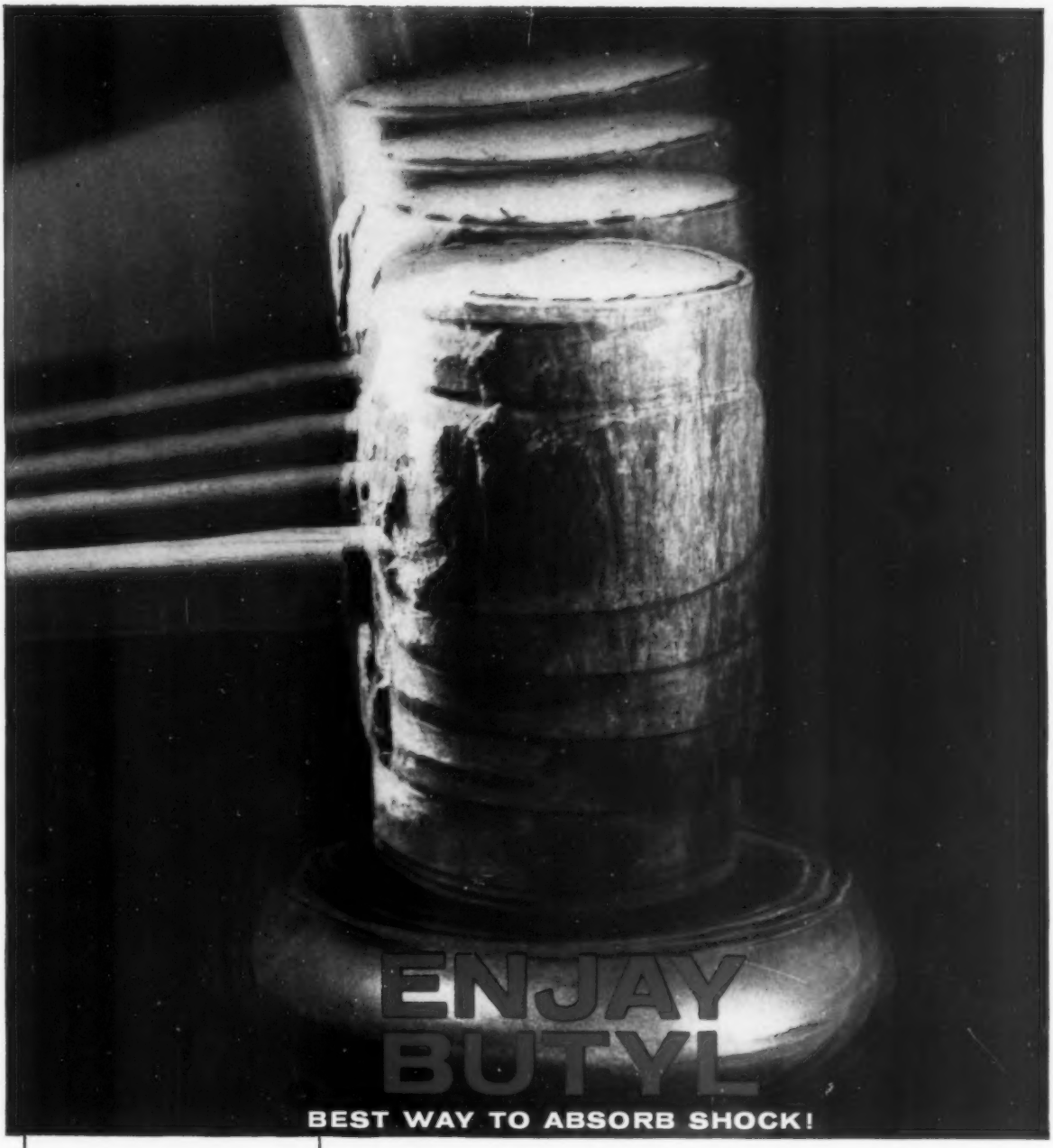
Titanium drops again as Mallory-Sharon announces across-the-board price cuts. Bar stock comes down 15¢ a lb, to $3.80, and finishing extras are reduced by the same amount. Size extras are cut as much as 60¢. Billet stock and sponge are reduced too. Base price for billet is now $3.80/lb (down 30¢); and for sponge, $1.62 (down 8¢ from previous low).

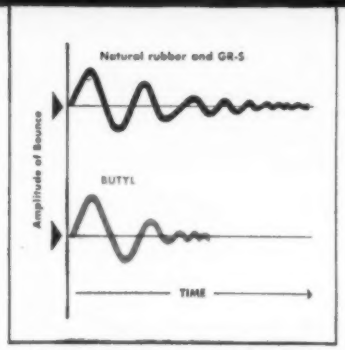
Mica cheap enough to use as insulation on transistors and other electrical and electronic components, and available without restriction, is offered by Perfection Mica Co, Chicago 22. This is a nonstrategic grade sold in the form of wafers like those pictured here, at a price ranging from $4 to $29 a thousand, prepunched to the desired shape.

—ARG



Prepunched mica wafers may be used for transistor insulation, as here; have low thermal gradient, good strength.





Butyl's superior shock absorption characteristics reduce amplitude of bounce in much less time as compared with other rubbers.

Enjay Butyl, because of its higher damping factor, absorbs shock energy *more* completely than any other rubber. Through simple variations in compounding or processing, you can build the right degree of resiliency for your requirements. Butyl is the ideal rubber for motor mounts, load cushions, sound deadener insulation, axle and body bumpers—and other shock, noise and mechanical vibration applications.

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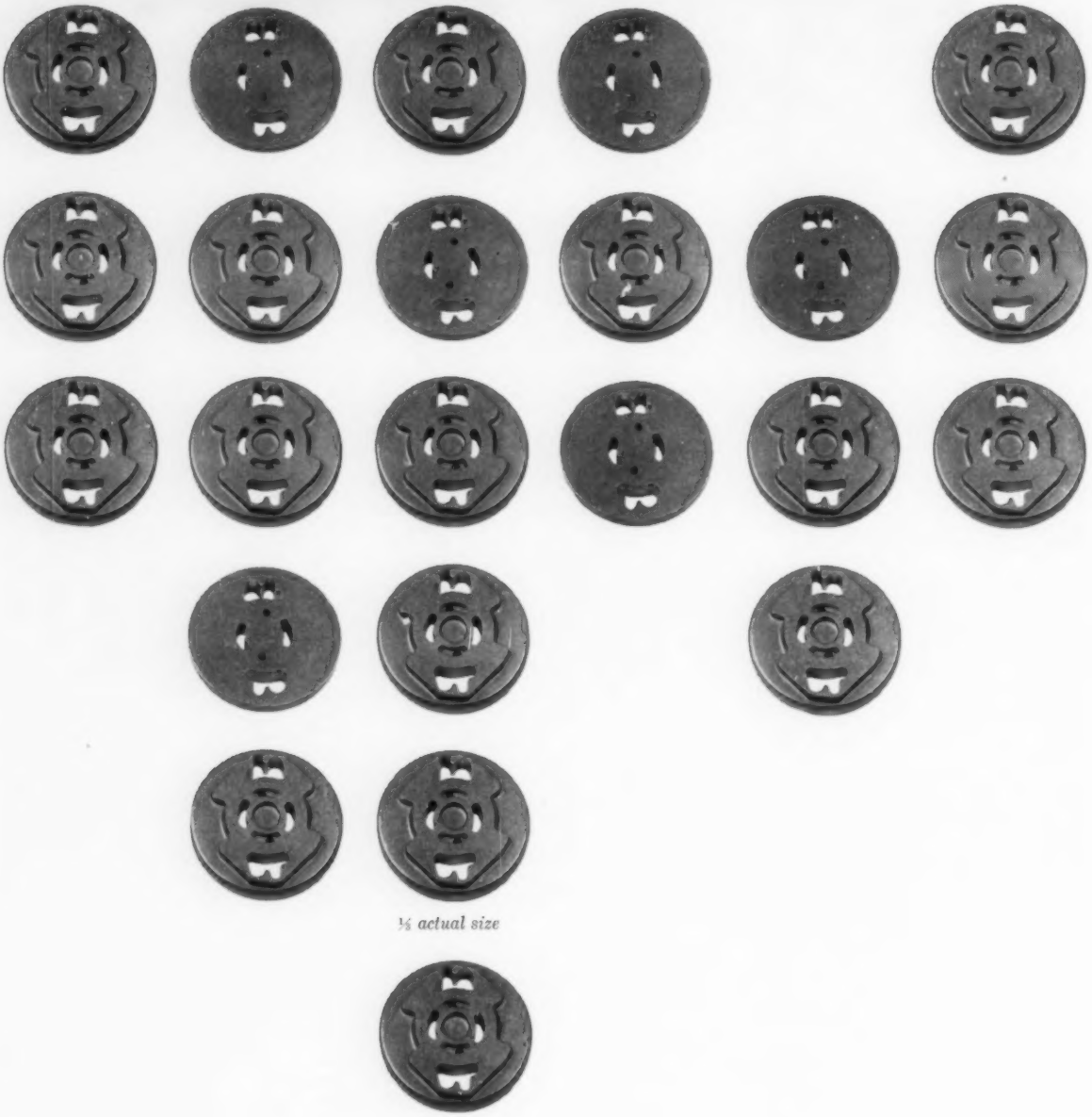


½ actual size

ECONOMY AND DEPENDABILITY are outstanding characteristics of these pressure plates—important components of power steering pumps. These sintered metal parts are in use today because Moraine Products visualized an improved product and developed a workable design. They also demonstrate other Moraine Products' capabilities—making economically, on time, and in quantity, parts that perform dependably under all operating conditions.

Vital parts for Industrial Progress

Moraine Products

Division of General Motors, Dayton, Ohio

Product Engineering HORIZONS

December 1, 1958

"The Crowd Cheered Barabbas . . .

"They snowed me with their culture—their paintings and sculpture," said an engineer recently back from the U.S.S.R. "I thought it was the finest art I'd ever seen, until I took a group of their engineers to some of **our art** museums. The Frick Museum is finer than the Hermitage in Leningrad, and our Metropolitan in New York beats the Tretyakov in Moscow all hollow. The only trouble was that I didn't know these things when I was there—because I'd never been exposed to our own art, our own culture."

This engineer is no greenhorn; he has, as the saying goes, "been around." But his whole scholastic training, and his engineering experience since, emphasized the practical. Humanistic and spiritual studies are too often looked down upon as impractical, hence to be avoided as almost effeminate.

This is no plea for culture, as such, because everyone has his own definition of what it is. And some demonstrations are pretty noxious. The point here is the need for breadth, for enough knowledge to provide understanding, enough to give a basis for evaluation.

The engineer must have at least a little knowledge of art, sociology, psychology, economics, politics—or he'll break his technical ideas against a wall of cultural resistance. He may, in fact, build the wall himself, because ideas are bought in the first case by people, not by technologists.

It's one thing, in this atomic age, to be preeminent technically; that we can do. But while we're doing it, if we neglect the broad knowledge of people and their motivations, we'll end up on the short end in world management. Read "The Ugly American", current best seller, to see how stupid we have been, and can be, in international affairs, particularly when we insist that everyone else must do as we do, think as we do—or we won't be bothered.

As Peter Viereck put it recently: "Yet without the understanding of man's inner nature, which impractical art and literature give us, and without the inner ethical restraint which religion gives us, our outer practical and mechanical progress is paving our road to hell with good inventions."

Technology can go just so far. We can invent, build, develop—but in the end the true measure of advancement will be whether or not these developments are accepted by people. To quote Viereck again: "Humanity is wilful, wanton, unpredictable. It is not there to be organized for its own good by coercive righteous busybodies. Man is a ceaseless anti-managerial revolution. Whenever enlightened reformers expect the crowd to choose Christ, it cheers for Barabbas. Whenever some Weimar Republic gets rid of some old monarchy, the liberated crowd turns its republic over to some Hitler. . ."

Art and sociology and psychology and the other humanities are not the whole answer—but they help (see *PE*—Mar 31 '57, p 77). Technical advance must not be hamstrung by misinterpretations at any level. Such misinterpretations can be intentional by the demagogue—take automation as a current example. Technical advance cannot move nearly as swiftly as it should if its protagonists try to bulldoze all resistance. As engineers, we must learn to understand people, as well as their cultural heritage—if that be necessary to get honest consideration and appraisal of what's happening in our world today.

Introducing Allied's

IRILAC™ #1000

New Clear Protective Coating for All Metals . . . as safe and easy to handle as Water!

New method of protection incorporates corrosion inhibitors in a water-soluble polymer base. Dries to an extremely thin, tough, durable coating—clear in color. Does not chemically affect base metal or any post-treatments. Used as a protective treatment alone or to enhance value of post-treatments.

Allied's new Irilac #1000 is a concentrated solution of a water-soluble polymer with built-in complex corrosion inhibiting materials. It was developed to answer the needs of the metalworking industry for a non-conversion process that will provide corrosion resistance and resistance to fingerprinting and abrasion on base metals and electrochemically or chemically finished surfaces—without changing the appearance of the metallic surface.

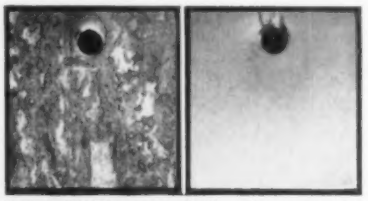
There are no hazards involved—Irilac is non-fuming, non-toxic, and requires no special fire prevention measures.

THE PROCESS

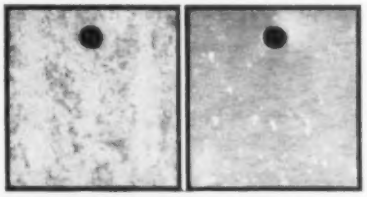
Irilac #1000 is diluted with water to provide a simple one-pass working solution. It is then applied by dip, brush or spray and forms a coating that quickly *bonds* to the metal surface without reacting with the surface.

THE PROPERTIES

The resulting coating is clear, transparent, thin yet durable. It has excellent water-resistant properties, and can be rubbed, handled and subjected to rough treatment. The surface to which Irilac has been applied is not altered—in fact, the transparent coating brings full tone to colored surfaces and clarity to iridescent surfaces. The water-thin physical characteristic of the solution means that the coating provides protection in recessed areas that are difficult, if not impossible, to protect with other methods.



STEEL PANELS: bare (left) and coated with Irilac (right) after 8-hour salt spray.



ALUMINUM PANELS: bare (left) and coated with Irilac (right) after 168-hour salt spray.

WHERE IRILAC CAN BE USED

Irilac #1000 can be applied to *any* metal—wet or dry—treated or untreated. All metals can be processed in *one* operation in the same solution. It can be applied in conjunction with any process—over Iridite, anodized, phosphated surfaces, black oxide, etc. Surfaces treated with Irilac provide a good base for paint.

APPLICATION ADVANTAGES

No other process or material available for the protection of metals offers all the application advantages found in new Irilac #1000:

1. It can be applied to any clean metal simply by dip, brush or spray. No special equipment is required.
2. Saves time—just apply and dry—no reaction time required.
3. No hazards involved—no exhaust or special fire protection equipment is required. Irilac is non-fuming and non-toxic.
4. Saves space. Presents no disposal problem. Low in first and final costs.

Because of its versatility and complete safety, Irilac has unlimited uses. For example, it will protect aluminum furniture, brass hardware and fixtures, steel parts of all types, zinc castings, etc. In fact, any base metal or plated surface, or those treated with electrolytic or chemical post-treatments, can be improved or enhanced with Irilac.

IRILAC #1000 MAY BE THE ANSWER TO YOUR PROTECTION PROBLEM

Our development staff will be glad to work with you to determine the significant benefits Irilac can offer you. Simply send us some parts and let us show you what Irilac can do. No obligation, of course.

Allied Research Products, Inc.

4004-06 EAST MONUMENT STREET
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***Manufacturers of* IRIDITE®, IRILAC™, ARP® Brighteners and Plating Chemicals**
West Coast Licensee: L. H. Butcher Co.

Torch at 20,000 F Gives Refractory Coatings, Parts

NEW YORK—The Plasma-arc torch, latest product of arc physics research at Linde Co Div of Union Carbide and Carbon Corp, has gone to work producing coatings and parts from refractory metals like tungsten, molybdenum and tantalum.

Photo shows it melting powdered tungsten and depositing it on an assembly of mandrels spinning and reciprocating under the brilliant jet stream. In this application small nozzles for experimental rockets are being made at temperatures of 20,000 F-plus. After coating, the mandrels will be etched away, leaving the tungsten deposit in shape of the nozzles. Intricate parts with walls only 0.010 in. thick have been made this way.

HIGH TEMPERATURE OVER ONE HOUR

Making the method possible is a specially designed arc-cutting torch in which massive amperage "strikes" an internal arc. Design of the arc chamber has been refined to the point that temperatures above 20,000 F can be sustained for well over one hour, thus making the torch a useful production tool.

An inert gas blown through the torch carries with it the metal powder to be melted and deposited. Wire-fed torches are currently being developed to increase deposition rates and broaden the range of coating materials. Both torches are insulated from the vaporizing effects of the high plasma temperature by a combination of external cooling and magnetic insulating effects in the arc itself.

POPULAR FIELD

Other companies interested in this field are Giannini (with its Plasmatron), and the Plasma-flame Corp; both are selling the high-intensity arc guns. Linde is not selling or leasing the guns currently, but is doing the coating work itself.

Allied fields of application are also opening up. Vitro Corp has just completed development work proving the feasibility of high-intensity arc-ionization refining of the rich Colorado rhodonite ore (a manganese silicate), which will make it unnecessary to depend upon India and Brazil for manganese ore. It accomplishes in one step what was once an expensive recycling process. Reaction Motors, Div of Thiokol Corp also has an experimental gun that's being used for research into rocket solid fuels, nozzles, coatings, and rocket chamber insulation.

Hypersonic wind tunnels set up by General Electric, Linde and other companies use a 15,000 F high-velocity plasma jet to simulate rocket reentry conditions. Linde indicates it will be possible to get gas velocities of Mach 100 at 0.1 mm Hg. According to reports, GE has already reached Mach 25.

Under Air Force contracts, Vitro, AVCO Research, Giannini Research, GE Aerojet-General, Rocketdyne Republic Aviation Reaction Motors, and Goodyear Aircraft are studying the use of magnetically directed ion flow for missile propulsion.

For more information on coating properties and designing parts for plasma-arc torch coating, see next week's issue.

Volkswagen Formula: Improve Parts but Keep Same Model

NEW YORK—"Offering people an honest value, a product of highest quality, with low original cost and incomparable resale value, has appealed to me more than being driven around by a bunch of hysterical stylists trying to sell people something they really do not want to have," Dr. Heinz Nordhoff asserted here in his address accepting the Elmer A Sperry award for himself, Dr. Edward A. Porsche (in memoriam) and their co-workers in designing and producing the Volkswagen. Nordhoff is now president of the company.

At the end of the war, Nordhoff recalled, the bombed-out Volkswagen plant had no windows and only fragments of a roof. It was located at a remote spot in the British zone, only a few miles from the Russians. The town housing its workers was primitive —had been mostly shacks for Italian construction workers. Yet, in the face of the enormous production and engineering problems, Volkswagen succeeded.

His decision to abandon annual model changes, Nordhoff said, served the company well even though a sharp departure from the practice of most auto companies. In 1947, 109.6 men produced one Volkswagen a day. Total production had dropped below 6000. Now, 17.9 men produce a car a day. 1958 production will exceed 550,000 units, the company employes 45,000 people and grosses $600 million a year. Because of a legal tangle resulting from Germany's defeat, the company still has no owner or definite capital setup.

In engineering concept, the Volkswagen is the creation of Ferdinand Porsche, Nordhoff asserted. Before the war, European designers recognized that large American cars were unsuited to Europe's roads, expensive fuels and limited facilities for service and repair. Porsche's small car with air-cooled engine in the rear, and all four wheels independently sprung, was based on fundamentally new design approaches.

Since the original Porsche design for "simple, economic, dependable transportation," each part of the Volkswagen has been refined and improved, yet models look the same.

Apply Less Expensive Method to Automating Machine Tools

LOS ANGELES—A system for automatic control of machine tools that combines point-to-point with continuous-path positioning control and eliminates the need for costly accessory programming equipment and personnel, is announced here by Topp Industries Inc. A forerunner of these tape controls was developed about 10 years ago.

Shown below and known as the Micro-path control system, its chief advantage is that no computer input is necessary to place the recorded program on magnetic tape; rather, recording can be accomplished by moving the controlled machine slide through the motions desired. Although the system cannot handle some of the specialized needs of some industries, such as aircraft skin milling, the company says the system will permit the medium-to-large machine shop to upgrade the equipment it already has. The system has been designed for addition to existing machinery with a minimum of modification, or for use as original equipment on both standard and special machine tools. Topp claims an over-all tolerance of ± 0.001 in. and a repeatability of 0.0002.

For each controlled axis of the machine, a position controller lets the operator direct slide movements and feed-rate control according to the amount of movement of the controller in either direction. The position controller directs a toggle switch which selects high or low feed range.

In operation, the operator sets the controlled slides to a reference point with recording controls in operation. Once at the reference point, the accumulating position reader and dial indicator are set to zero. After switching to record, the operator need only manipulate the control to move each slide to the required dimension.

The pulses generated while moving the slide according to the operator's setting of the position controller, are recorded. By manipulation of the control, both rapid advance and slow approach can be programmed.

At the desired position, the operator programs in all auxiliary functions of the machining operation such as spindle start, quill down, coolant on, etc. This process is repeated for each successive point in the program.

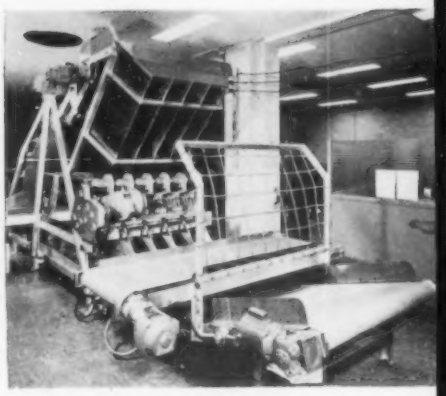
To simplify programming, recording is done at ¼ actual speed. For instance, if an operator wants to program 50 in./min. traverse speed with a 6 in./min. approach speed, the actual movement of the slide during programming would be only 12½ in./min. and 1½ in./min. This simplifies the problem of positioning accurately to a point at the highest practical feed rate. The operator can program in "fail-safe" check points as desired to assure that the control slides are actually in the programmed position.

A contour recording stylus permits simultaneous control over positioning of both axes. As with the individual axis position controllers, the recording stylus has a high-low speed range selection with a pressure adjustment control which establishes resistance of the stylus to operator deflection.

The electronic system is set up so that slight pressure applied to the side of the stylus finger simultaneously moves the table in the direction of the stylus pressure, and data are recorded on the proper tape channel. This permits recording from accurate drawings, precision-scribed layouts, and parts. Recordings can be made of full-size or 4 x 5 size drawings.

Topp says that cost of the new system will be $12,000-$15,000.

Point-to-point . . .
and continuous-path positioning control are combined here by Topp Industries, Inc., to provide less expensive magnetic tape programming of machine tools. Circle locates stylus directed by positioner which, in turn, is controlled by operator who can direct slide movement, set feed rate from recording control console at left.



30,000 pieces of mail an hour . . . are sorted by this machine and passed on to a companion machine that cancels stamps and stacks letters so addresses run in uniform direction. The machine accepts a pile of random mail, separates standard letters from such other items as parcel post packages and hotel keys. A prototype model of this Emerson Radio and Phonograph Corp device is being tested at the Main Post Office, Washington, D. C. Its companion cancelling machine employs a scanning device to locate the stamp—distinguishing it from Christmas seals, trademarks etc.—cancel it, and guide the letters into one of four stacks.

Vickers Reveals Liquified-gas Motor

DETROIT—A hydraulic motor capable of operating on liquified gases at a temperature as low as −320 F and also capable of handling incoming gases at 5000 F is now being developed at Vickers. They described their experimental unit at the annual Vickers Hydraulic Conference here.

Development of this unit is one step in the program aimed at keeping hydraulic systems abreast of air and space travel.

Transports operating in the Mach 3 range will probably become a reality much sooner than could have been expected even a year ago, according to W. Bobier, Vickers' chief engineer in Detroit.

Bobier estimated that such a transport will need a fluid-power system considerably larger than that now used on jet transport aircraft, that the operating temperature will probably be above 500 F, and that the requirements for reliability and weight saving will be more stringent than for any other type of aircraft. Life expectancy of the hydraulic system in a Mach 3

transport will be 2000 hr minimum.

The problem becomes even more complicated in a boost-glide type of vehicle, where the most advanced system (Vanguard) requires 1000 lb of takeoff weight for every pound of orbited payload.

Advances already achieved or in advanced development for these future requirements were reported by R. D. Montgomery, of Vickers. These are:

• Seals for temperatures above 400 F will be almost exclusively metallic, not only because of the temperature, but also for compatibility with the fluids involved. Elastomers will not give satisfactory service, and this will preclude the use of conventional lip-type seals, restricting seal design to the open face type. Metallic O-rings are not expected to give any trouble.

• Reduced lubricity of fluid and lower fatigue strength of metals at 400 F and higher call for new bearing materials. A number of alternate approaches have already been tried successfully, and no major breakthrough is needed in this field.

• Much work needs to be done in fluids, though present developments give hope that satisfactory fluid media will be developed. One possibility being investigated is the use of exhaust gases from solid fuel propellants as fluids for part of the "hydraulic" system. Difficulties here are in the contaminants produced by the envelope surrounding the solid fuel rods, but some hydraulic system elements capable of handling these contaminants have already been tested successfully.

• Need for high horsepower-per-pound ratings means increased speed of rotating pump. Improvements already made have upped previous maximum speeds. Most significant improvement is the development of a new eleven-cylinder pump, which has raised rpm from 3600 to 6200, with speeds as high as 8000 rpm being maintained for short periods without injury to the system.

• With the new 11-cylinder pump, sustained operating pressures of 4000 psi have been maintained, and pressures in the 5000-psi range have been reached on a non-sustained basis.

• The trend to keep the fluid system clean is now paralleled by design of units that tolerate contaminants, like the pump that handles exhaust from solid fuel. A pump of contaminant tolerant design has been tested successfully on fluids with a contamination content three times the maximum allowed by Air Force specs.

ARPA Projects Stress Science for Defense

NEW YORK—The Advanced Research Projects Agency has let contracts for about 40 projects amounting to $260 million for research on basic sciences to advance defense capability, Roy W. Johnson, Director of the Agency, said here while attending the annual meeting of the American Rocket Society.

Among important projects on his agency's roster, Johnson listed a $100-million study to look into all aspects of a missile in flight. Such information would lead to better defense against enemy missiles. Studies are concerned with infrared radio and even air patterns created by a missile. The latter are often a sure way of identifying a flying object, Johnson said.

In propulsion, ARPA has a $20-million project for solid-propellent chemicals. These, Johnson believes, will eventually prove most efficient for rockets. The projects in basic chemistry are searching for brand-new chemicals, not new combinations of those on the shelf. ARPA is shooting for fuels with specific impulse well over 300.

Other projects include a high-energy upper-stage rocket to fit an Atlas or Titan which is expected to put a 4- or 5-ton payload in orbit. With this power, ARPA hopes to get a communication satellite into stationary orbit. At present, Johnson pointed out, the U S government uses half the nation's communications channels, hence limiting commercial expansion. Communications satellites would relieve the overcrowding.

The Air Ballistics Missile Agency has gotten from ARPA a contract to cluster eight engines for first-stage booster with a million-and-a-half-lb thrust. By 1960 Johnson hopes this engine will be flying. It will be capable of putting 25,000 lb into very high orbit. But achieving a million-lb thrust for a single engine, Johnson believes, is a six- or seven-year project.

Tactical cloud cover—an infrared sensing system for weather information—is also on his docket Johnson said.

He pointed out that ARPA contracts are given to the services or industrial firms after his agency has investigated their capability for carrying out a proposed assignment.

MORE RESEARCH NEEDED

The nation's astronauts who delivered papers at the Society's technical sessions expressed high hopes for man's space venture—after a lot more fundamental research is available and applied. A session on missile structures revealed sizeable areas where engineering design is handicapped by lack of knowledge. For example, no satellite has been in space long enough to provide conclusive data on the effect of radiation on structural materials.

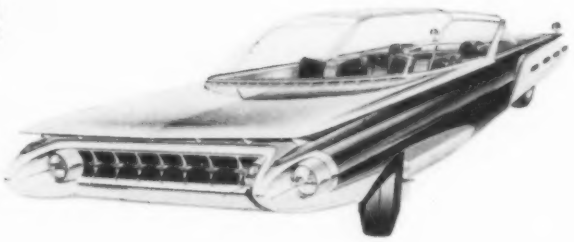
Commenting specifically on space craft design problems, George D. Cremer, senior staff engineer and Richard S. Mueller, research engineer, Solar Aircraft Co, told the Structures session that braze joining is firmly established as a superior method for

Cylinder from sheet . . .

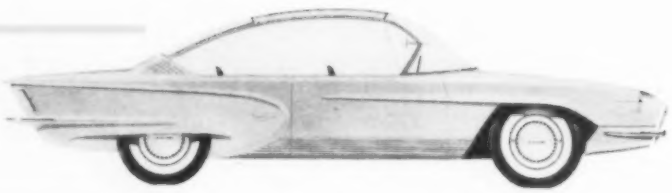
of 160 in wide alloy steel was displayed by Lukens Steel Co at the Astronautical Exposition of the American Rocket Society's Annual Meeting. Large steel sheets will be used for the bodies of second generation rockets and will require less welding, the company said. Lukens also displayed a dome with uniform tolerances of ±0.003 in. The company would not reveal details of the new process it has developed for making such high precision domes.

Why not an all-aluminum car?

Detroit is getting a lot of free advice these days (see p 26), now Kaiser Aluminum designers suggest the all-aluminum car. The bumpers, grills, hood, body, doors, engine—everything in the car above is cast, extruded, or formed aluminum. This "Pele" is their "family" car—producible on existing production lines.

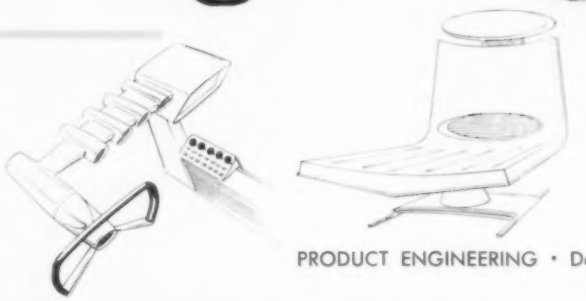


More conventional in internal components, the "Haleakala" (right) has cast-aluminum engine support arms, firewall and floor sections. The hood is stamped aluminum and runs the full width of the car. Note the parking "feelers" extending from head-lamps.



The "Menehune," American small car (right), seats six, has a 112-in wheelbase and features a pan-type frame made up of side sills, fender skirts, rear-wheel housings, seat risers and floor.

A station wagon, the "Waimea" (right), with engine placed under the driver's seat has front wheel drive. Glass over the driver's section slides back into the rear panel. Rear area will take conventional or bucket seats, fold-away beds, cabinets.



Control pod (right) combines steering mechanism on a cantilever with instrument dials built in. Swivel bucket seat is an exposed aluminum shell covered with foam rubber. Head rest is adjustable.

4 Ounce Contact Force Makes Relays More Reliable

Contact force of 4 ounces per contact on 50 "G" models and 2 ounces per contact on 30 "G" models of "Diamond H" Series R and Series S miniature, hermetically sealed, aircraft type relays is one of the most important factors in their proven high reliability.

Though absolute reliability of any similar device is impossible to guarantee—a bitter fact of life recognized by all electronic engineers—close approach to this goal by the relays manufactured by The Hart Manufacturing Company is the basic reason they are found today on many of this country's headline-making missiles.

In addition to contact force far beyond that found on other relays, "Diamond H" relays have greater contact cleanliness. Self-contamination is virtually eliminated by a completely inorganic switch mechanism, as well as use of coil materials which will not dust, flake or out-gas.

Finally, the high degree of reliability that is designed into these relays is maintained in their manufacture by high quality workmanship and a stringent inspection policy at every stage.

In addition to missiles, and their ground control systems, Series R and S relays are designed for use in jet engine controls, computers, fire control, radar and similar critical applications.

4PDT units, they offer an extremely broad range of performance characteristics, including temperature ranges from —65° C. to 125° and 200° C.; ratings to 10 A., 120 V., A. C., and 26½ V., D. C., with special ratings to 400 ma. at 350 V., D. C., or down to millivolts and milliamperes. Dry and wet circuits may be safely inter-mixed.

For more information, write today for Bulletins R250 and S260. For quick facts about "Diamond H" switches, thermostats and other devices, ask also for a copy of the "Diamond H" Check List of Reliable Controls.

THE **HART** MANUFACTURING COMPANY

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manufacturing high strength-weight components. And it opens the way to new design freedoms for structures and materials engineers (see next issue of PRODUCT ENGINEERING for brazing article by these two men).

The technique, they said, is especially suitable to interplanetary space, because welding may be accomplished by focusing the sun's radiant energy. Hence, space offers high vacuums and fast heating–ideal brazing conditions.

They predicted advances in brazing to meet space age requirements will include the refractory metals and alloys of tungsten, rhenium, tantalum, columbium, and molybdenum; the lightweight alloys of lithium, boron, and beryllium, and the special-purpose compounds–boron carbide, boron nitride, silicon nitrade, molybdenum silicide, hafnium carbide, uranium carbide, uranium hydride and europium oxide.

HEAT SOLUTIONS

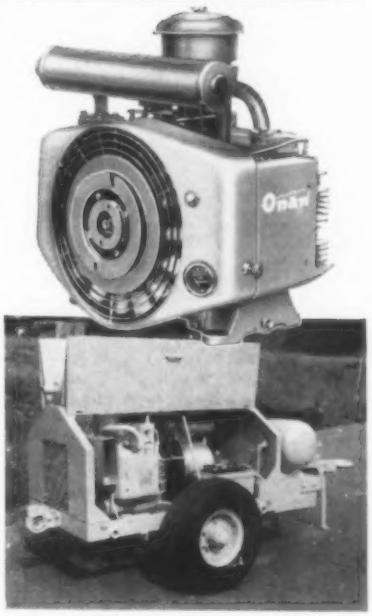
In a ballistic-type recoverable missile the heating problem is more intense but shorter lived than in a glide-type craft, he said. For a blunt-nosed ballistic missile, beryllium heat sink or ablation now appear to be the best low-weight solutions. For a glide vehicle, radiation cooling is superior, except for leading edges of wings where added protection against higher temperatures is needed.

Low-density materials, especially beryllium, said coppa, are very effective as meteoroid shields. In space ship design with this material, the meteoroid will penetrate outer skin, fragrant, and impinge on the inner wall over a wide area–hence losing its destructiveness.

Paul E. Sandroff of Massachusetts Institute of Technology predicted that interplanetary rockets will be extremely thin-wall pressure-stabilized shells. Such designs will place increasing emphasis on development of exotic and expensive materials. Choice of particular material and structural contour will be determined by ratio of payload to rocket weight. He pointed out it would be economical to fabricate the final stage of a 4-stage chemical rocket for Mars of solid platinum at $2000 a lb if every pound of platinum saved an ounce of weight. For lower weight propulsion systems such as nuclear or electric-ion engines, the designer will find that saving an ounce of structural weight will not be as important.

Onan PRODUCTS

AIR-COOLED ENGINE NEWS



In military service, too...

Onan CCK engines get the tough jobs

This rotary compressor, driven by an Onan CCK engine, is being built in quantity for the Air Force by the Davey Compressor Company. It is rated at 16CFM at 200 PSI and after passing the 1,000-hour continuous operation test, delivered more air per minute than at the start of the test.

The Onan CCK engine combines four major advantages for outstanding performance. It develops 12.9 H.P. yet weighs only 148 pounds. Its alternate-firing, two-cylinder design is compact and free from vibration. Large bearings and rugged construction make it a dependable, long-life power source.

Onan CCK power can step up the performance of *your* equipment.

REAR VIEW showing crankshaft extension.
Overall length including crankshaft is 14¾"; height 21⅛"; width 18½". Rope starting is standard; recoil or electric starting available.

Onan also builds military gasoline engines; air-cooled Diesel engines, electric plants and generators. Write for information.

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A TONIC for TIRED METAL

Why have fatigue problems when it's easier to do without them?

C. R. SMITH, *Design Specialist*
Convair (San Diego) Div. of General Dynamics Corp.

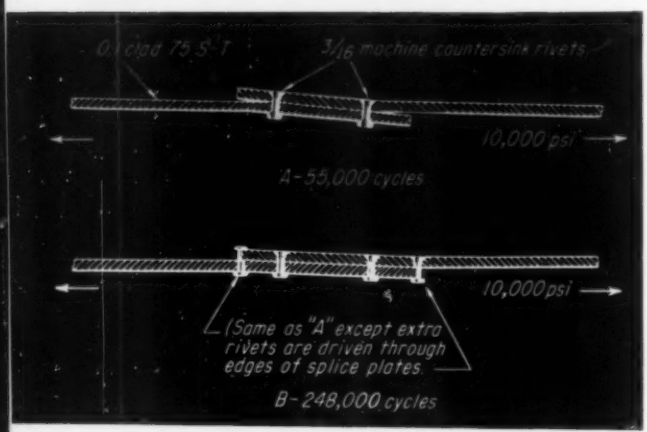

0.1 clad 75 S-T
3/16 machine countersink rivets
10,000 psi
A-55,000 cycles
10,000 psi
(Same as "A" except extra rivets are driven through edges of splice plates.
B-248,000 cycles

FIG. 1—A conventional joint tries to align itself with the load by bending at the already overloaded rivet. Addition of two rivets can increase life five times. Bending stress is taken up by rivets which cannot support a shear load, leaving shear-loaded rivet to carry its load uncomplicated by bending. —A case of divide and conquer.

Illustrated by TONY ADAMS Illustration Group, Convair San Diego

What causes fatigue in built-up structures? Too much stress! And too much stress comes from too much load in the wrong places.

The solution to the problem, then, is to put the right amount of stress in the right places. One or some combination of the following six ways will be effective:

Do away with the load or remove the troublesome part entirely.

How? The following examples should point the way:

Hydraulic tube is failing because of vibration. Obviously, beefing up the tube to withstand the vibration isn't as good a solution as adding a support so that it won't vibrate.

Bell crank support is cracking. Maybe you can do away with the bell crank altogether. Try running a hydraulic or electric line directly to an actuating cylinder or motor.

Window corners cracking. Do away with windows. In jet transports, you are too high to see anything out of them anyway. If you must have windows, however, provide generous corner fillets. Theoretically, elliptically shaped windows whose height is 1.414 times the width are best.

Chase high stress elsewhere

Simple rounding of corners is a typical example of chasing undesirable stresses where they can do no harm. Less obvious, but just as simple, separate the bending stress from the shear stress by adding a rivet at the edge of a joint, as shown in Fig. 1.

Sometimes a grease fitting can be moved to a lower stressed region. At a rod end, for example, the worst place for such a fitting is through the center of the bearing 90° to the direction of loading (Fig. 2). A better place is in the direction of load, either at the end or through the shank.

Adhesive bonding distributes high stresses. Well-bonded joints will have a fatigue life almost equal to that of the parent material.

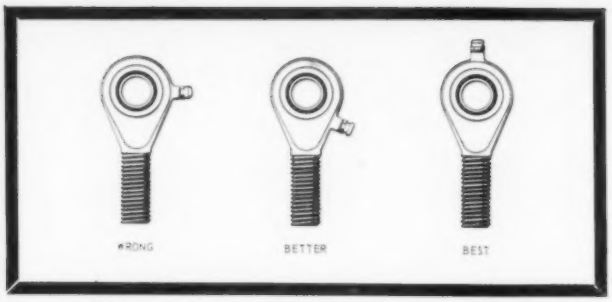


FIG. 2—A grease fitting at a rod end belongs at the lowest-stressed position—not where the fitting is most likely to crack.

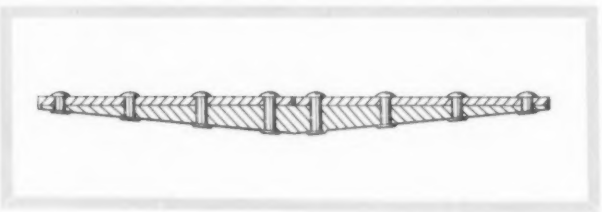


FIG. 3—If the butt plate is tapered, excessive stress will not be transmitted to the vulnerable first and last rivet rows.

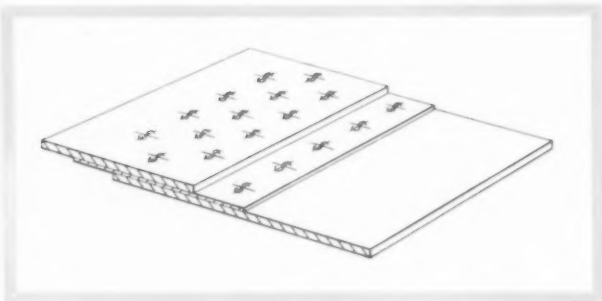


FIG. 4—In spotwelded lap joints, the extended shim picks up part of the load before the main structural lap starts.

Make the supporting structure too flimsy to load up fatigue-prone parts.

The first line of rivets in a joint puts too much load in the wrong places. The solution; simply whittle away the underlying structure until it cannot load up the first rivet or row of rivets (Fig. 3). A good rule of thumb here is to make the understructure so thin at the first rivet that it cannot support a load causing fatigue failure in the main structure. One half the thickness of the main sheet or less is desirable. Bearing failure on the underside is no problem fatigue-wise, as there is no stress here except as introduced by the rivet. If the rivet loosens, all of the load will be shifted to the remaining rivets–perfectly all right because now the rivet only has to take out the bending stress without carrying shear load, very much like the rivet in Fig. 1.

Needless to say, the remaining rivets should have static strength sufficient to carry the full load.

What has been said of riveted joints is also true of adhesive and spotwelded joints. Feathering down the edges of splices has long been a practice for adhesive bonding of metals. While this hasn't been a practice for spotwelded joints, the principle of making the understructure too flimsy to load up the main structure should hold true for them as well. This could possibly be done by inserting a shim between faying surfaces (Fig. 4) and extending the shim out so as to engage the first row of spots.

A note of caution should be observed at this point. Splice plates are also vulnerable to fatigue; and reducing the load along the first row of rivets in the splice plate (the last row in the sheet) is highly beneficial. If can't be done, make certain that the splice plate is thick enough in the middle to take the full load.

Confuse and befuddle

A series of holes is better than a single hole. The concentration factor for intermediate holes in a row spaced 3 diameters in the direction of load is about 2.1, (R. E. Peterson, *Stress Concentration Design Factors*, pp. 91, 94, and 95, Wiley) whereas that for a single hole is 3.0. The end hole, however, has a concentration of 2.8. In the case of riveted joints, this is the hole that has the highest load. Accordingly, longer life can be had by driving a dummy rivet in line with the loaded rivets, so that the highly loaded rivet takes an intermediate position. This has more than doubled fatigue life in some cases. For best results, the dummy should be placed close to the loaded rivet, roughly one diameter away (Fig. 5). The edge-driven rivet in Fig. 1 also acts as a dummy.

(Continued on next page)

A TONIC for TIRED METAL

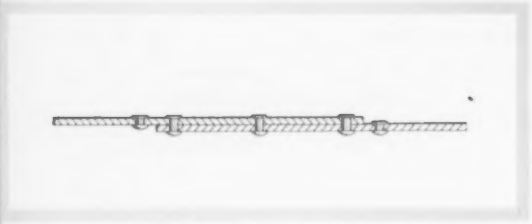
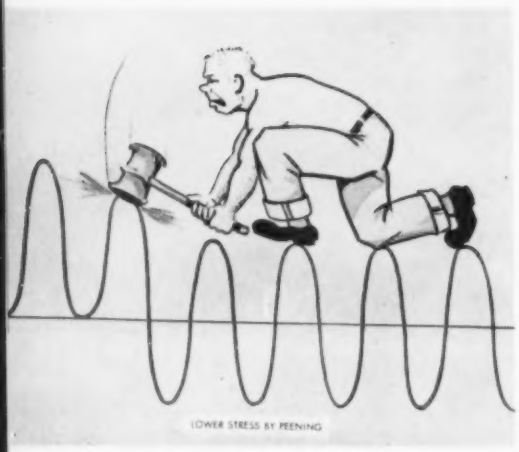
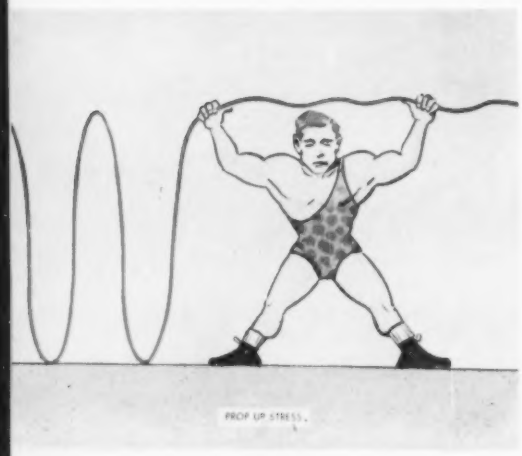


FIG. 5—A dummy rivet, spaced one rivet diameter away from the last working rivet shares the load with the highly stressed end rivet.





Hold down stress by residual compression

This is an old standby that is not too well understood. The idea here is that the cycling stress isn't so bad if it can be shifted downward–it's the tensile stress that does most of the damage.

The reason most parts fail from fatigue is that they contain obstructions to free flow of stress (stress concentration). The stress fluctuation at this point is many times higher than the nominal fluctuation only a short distance away. Accordingly, an improvement in fatigue life can be had if we shift the mean stress downward at the point of concentration, even at the expense of added tension some distance away. Thus, shot peening of fillets will add considerably to the fatigue life. Remember, however, that the protective compression stress cannot be held without adequate tension area away from the concentration. Thus, a bent-up sheet that fails in fatigue at the bend radius is not likely to improve with shot peening.

There are a number of other ways of inducing residual compression, such as overloading the part or using a punch to peen a hole. Such things as inspection holes in rod ends can be improved by driving a taper punch so as to enlarge the hole by about 0.002 inch or more, depending upon the hole size.

Prop up the stress so it can't cycle

If you can't lower the stress, prop it up to prevent cycling. Thus, driving a rivet in an open hole provides a prop to lower the cycling stress. This may improve fatigue life by as much as a hundred times, even though the peak stress could be higher than without the rivet. Although not so apparent, this same propping effect is manifest in the tightening of engine head bolts or in the pressing of bushings.

This also illustrates the importance of maintaining tightly driven rivets in all joints. Occasionally, the nature of loading is such that something has to give and usually the rivet loosens–exactly what you don't want to happen. However, proper amounts of taper in the splice plate at the first rivet allows loosening to take place there, instead of in the main structure. Loosening rivets in the understructure at the first row does no harm, provided that the remaining rivets are adequate to carry the full load.

Combinations of stress manipulations

Although combinations of these methods may seem difficult, some lend themselves quite readily to combined fixes. Punch-peening holes prior to riveting, thinning down splice plates in addition to edge rivets, and shot peening in addition to making radii more generous are a few instances.

When using these suggestions, a certain amount of good judgment is expected. Thus, if edge rivets are employed, it is only the course of wisdom to avoid using them where high stresses exist along the edge (it would be foolish to put rivets through the edge of a spar rail to protect a leading edge). Also, since the propping effect of a rivet is important, edge rivets, when used, should be driven hard enough to swell the hole, even if they become lopsided in doing so.

Consideration of how to put the right amount of stress in the right places will also point out how common faults in everyday design can be reduced, if not corrected. Stress concentrations are caused by notches, nicks, holes, bumps, and sharp corners, among many others. Avoidance of these is mandatory if good service life is expected. ■

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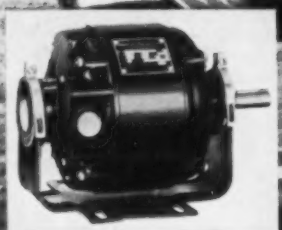

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EIGHT DESIGN AUTHORITIES . . .

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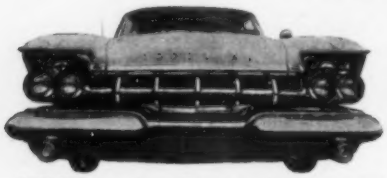


IMPERIAL

STEVENS: An effort to alter an original concept by **subterfuge.**

SUNDBERG-FERAR: **Congratulate Chrysler** for resisting temptation to "gorp" up the best and **one of the most automotive-looking** rear-fender designs. Front end not as good as '58.

LINCOLN

STEVENS: Again face-lifted, and **perpetuates angular, beveled, tailored look.** Diagonal dual-headlight mounting is still inadequate alternative to two lights arranged vertically or horizontally . . . if **Gargantuan dimensions** impress, it's a prestige car.

SUNDBERG-FERAR: Still **sleek-looking but far too long** . . . rear end improved over '58, but front end has lost simplicity of that year's model.

CADILLAC

KAUFMAN: Solemn fooling-around achieves **elaborate boredom** —maybe that's what is wanted!

STEVENS: Exaggerated rocket-to-the-moon approach to Cadillac's fishtail trademark is **overdone and undignified** for the carriage trade.

SUNDBERG-FERAR: From a prestige car, Cadillac has **degenerated** into a symbol of vulgar ostentation . . . rear fender doesn't relate—**no functional significance** . . . car has heavy, truck-like look.

- **Edgar KAUFMAN** • author, design consultant, New York
- **Robert KOLLI** • professor, industrial design, Pratt Institute, Brooklyn
- **Raymond LOEWY** • industrial design, New York
- **Lawrence E MOREHOUSE** • director, Human Performance Lab, UCLA
- **Dino OLIVETTI** • president, Olivetti Corp of America, New York
- **Brooks STEVENS** • industiral designer, Milwaukee
- **Carl SUNDBERG-MONTY FERAR** • industrial designers, Ferndale, Mich.
- **Walter Dorwin TEAGUE** • industrial designer, New York

What do some of the leading industrial designers, design educators and critics think of the '59 American cars? PRODUCT ENGINEERING decided to ask them—primarily because our readers are designers too. A kit containing a questionnaire and several views of the various makes was sent to the design authorities listed above.

Not everyone who was invited cared to participate. As a prominent West Coast designer wrote, "The fact is I feel that the problems involved in automobile styling, as they stand, belong to a world other than the world of design, and if '56, '57 and '58 are any criterion, it would be futile to place any evaluation on the American cars for 1959." Another designer, Raymond Loewy, preferred to comment with sketch pad, on the DeSoto and Cadillac—see our cover.

All those who replied demonstrated an impressive desire to reach honest, helpful opinions, highly constructive and clearly on the practical side. This earnestness was one of the things all the panel members had in common, together with a desire to see their colleagues, the automobile designers and engineers, have a larger voice in the final Detroit product.

Here are summaries of the answers to the question we asked:

1) Are the '59 cars over- or under-decorated . . . and do these effects enhance or detract from the basic designs?

Although some noted that ornamentation, trim and chrome were more restrained on a significant number of the '59 models, most felt that trim was still excessive on most makes and that it

...EVALUATE '59 CARS

detracted from over-all appearance, particularly on those makes where the basic body lines were good. Professor Morehouse noted that lights were often used as decorative elements to the point where they were no longer arranged for "optimal function." Walter Dorwin Teague: "Asking whether these models are overdecorated is like asking if the Empire State Building is tall or the ocean is wide." Kolli: "Excessive concave and convex skin treatment has already caused car laundries to modify equipment in order to clean crevices."

2) Does the increased glass area improve function, safety or style?

At least where the glass was handled well by the car designers, the panel was virtually unanimous in saying that style was enhanced. The fears for safety were just about as unanimous, with a number of worried questions about the effects on structural soundness, optics, and bad-weather driving. As for function, one panel member pointed out that visors would probably be required on some of the new models. Sundberg-Ferar: "We question whether the increased area of visibility is either necessary or desirable for the driver . . . and in a roll-over, will the new tops protect occupants any better than a convertible?"
(See PE, Nov 17 '58-p15)

3) Does increased length and size add to the value of these cars?

No one on the panel believed greater length improved appearance or riding qualities, and most mentioned the parking problems associated with what some of them termed "useless overhang," as opposed to commensurate increases in wheel base and consequent larger interior dimensions. Dino Olivetti felt riding stability will lessen on curves and slippery roads because of overly long rear sections. Brooks Stevens: "Increased length is no longer required for riding qualities with present-day suspensions. Length can only reflect in a car's value from the standpoint of what it cost to put it there in the first place."

4) Do you think the '59 cars represent a further step in the evolution of auto styling, function and safety?

Here, the panel was clearly divided, with Kaufman and Stevens saying they felt the '59 cars did represent a step forward, and Morehouse, Sundberg-Ferar and Teague disagreeing. Morehouse: "I somehow feel that designers are trying to get away from the carriage or buggy

DESOTO

KAUFMAN: Designers **should have some of the freedom** to turn around that their engineers have.

STEVENS: Chrysler's '59 products are **not necessarily esthetic mprovements** over the '57 "forward look."

SUNDBERG-FERAR: A hybrid; has an **Olds front and Dodge rear** . . . neither very good to begin with.

FORD

KAUFMAN: Apt juggling of the forms at junction of doors and rear window. **Slight overdose of "jewelry"** is probably to be paid by first owner to anticipate taste of second.

STEVENS: Boxy appearance of the '58 **doesn't measure up to lightness and grace** of '57 Fairlane. Return to large, round taillight trademark is spoiled by seemingly superfluous smaller lights in fins.

SUNDBERG-FERAR: Back-up **lights look like flashlights stuck on fenders** as an afterthought; but vast improvement over the '58's. Rear-window treatment is good.

CHEVROLET

KAUFMAN: Instead of high, wide and handsome, it's **low, wide and dumpy.**

STEVENS: Bat-wing-flared rear-end design is **exciting, fleet and unusual** without being exaggerated . . . tail lights are unfortunate aerodynamic cliches.

SUNDBERG-FERAR: Fins **mean nothing functionally or esthetically** . . . make the car harder to clean and the trunk harder to get into . . . tail lights ridiculously big for a so-called "small" car.

DODGE

KAUFMAN: **Skillful styling** coordinates basically different elements: road-hugging base, zippy top.

STEVENS: Obvious and **strained effort** to alter by over-ornamenting.

SUNDBERG-FERAR: **Poorest example of new-car design.** Front end has conflicting motifs of stringy chrome.

STUDEBAKER LARK

KAUFMAN: Sturdy basic shape with **chrome applied like greasepaint** on a clown's face, creating a linear image unrelated to form.

STEVENS: If American public is looking for a **smaller, conservative, plainly styled automobile,** this is it. Roominess is commendable, achieved by retaining tonneau tooling of smaller '58 sedan, surrounded by new quarter panels, hood and deck—but with a minimum of imagination. Surfaces are rounded, soft and not particularly tailored or exciting.

SUNDBERG-FERAR: Lacking money for complete retooling, this is **probably best that could be done** in the way of a cosmetic job of face-lifting.

TEAGUE: It's best of the lot, **but has some wholly unnecessary convolutions,** and irrelevant and distracting chrome that interferes with over-all lines.

MERCURY

KAUFMAN: Front and back **consistent if prissy** . . . side view is a medley of contemporary cliches.

STEVENS: Perpetuates and exaggerates sculptured sheet metal approach . . . **windshield and top concept are newest notes.**

SUNDBERG-FERAR: The '58 had atrociously **corned-up design** and the '59 is **no improvement** . . . front is perhaps a little better.

OLDSMOBILE

KAUFMAN: **The '58 was manic,** this year's is **depressing.**

STEVENS: Attempts to individualize itself with Oldsmobiliana from former models . . . headlights arrangement logical and clean . . . several steps **further toward over-ornamentation** than Buick.

SUNDBERG-FERAR: Taking off some of chrome with which '58 was burdened has improved appearance . . . **rear is definitely better,** except for rear fender, which doesn't go with rest of car.

PLYMOUTH

KAUFMAN: **Weak-looking** all around.

SUNDBERG-FERAR: Little change in styling, but **in right direction.**

design, but that they are still failing. We see 'science fiction' autos which are successful breakways, but yearly models since World War II are making little progress." Kolli: "Good design will not become big business until the consumer matures and expresses a need for it."

5) Is there adequate individuality among the '59 American cars? Or should the only differences be price and size (as an element of function)?

Most of the panel felt there was insufficient differentiation between the new autos—none believed the only difference should be price and size. Stevens pointed out that sameness of appearance can be a result of approaches to the same basic problem all of which must be predicated on enormous investments in tooling and the necessity of parts interchangeability. Stevens also said esthetic trim and detail can be the only uniqueness and identifier. Sundberg-Ferar: "The designs of all manufacturers tend to look too much alike . . . General Motors took Buick and made it 'the car' for '59. However, all their other cars currently use the same basic body shell. The result is that whereas Buick looks as if it were designed as a single package, the designers of Chevrolet, Pontiac, Oldsmobile and Cadillac have had to force their cars into unnatural contours and far too much chrome has been applied in straining for a superficially 'different' look."

6) Are you satisfied with the choice of available body types?

Not every panel member expressed an opinion here, but those that did were evenly divided. Sundberg-Ferar: "There are plenty of different body types available—but only in *big* cars. We would like to see the public offered a wider choice of *smaller* cars."

7) Which car do you like most? Which car do you like least?

Almost nobody agreed with anyone else. Buick is the only car that got more than one vote (2), as the car liked the most. The Continental, Chevrolet, Thunderbird and Lark each got a vote. Edsel, Rambler, Imperial, Cadillac and Dodge each received one "least" vote: Teague: "In a blindfold choice I could be sure of only one thing: I would come up with a revolting car much bigger and more expensive than necessary."

8) What suggestions do you have for an improvement in design?

Kaufman: "More confidence in de-

...EVALUATE '59 CARS

signers, less listening to commission-centered salesmen"

Kolli: "Plan for the now-forgotten minority of buyers—elegance without flash"

Morehouse: "Seats individually adjustable and designed to accommodate human form in action (driver) and in repose (passengers). More functional design of controls, simplification of instruments"

Olivetti: "I wonder if bigness in cars, while it may protect riders, may deter from agility and speed of stopping. Rocket design in a rocket has a function. In a car, it has not. Making a rear light resemble rocket exhaust is not very rational"

Stevens: "Cannot be answered in a sentence, because problems confronting the industry are so complex, and so dependent on vast amounts of tooling and on economic conditions"

Sundberg-Ferar: "There is not a single 1959 model that could not be improved esthetically, while at the same time making it less expensive to build. Meaningless convolutions of sheet metal and diecastings only run up the costs, which must ultimately be paid for by the purchaser. Appliance manufacturers have learned to simplify styling and remove surplus ornamentation, giving customers better looking, more serviceable products which cost less to build and sell better. Sooner or later, the automobile manufacturers will make the same discovery"

Teague: "I would suggest starting all over—design a car logically functionally and esthetically right"

And now . . .

WHAT DO YOU THINK?

WHAT DOES DETROIT THINK?

We would like to hear your opinion of the '59 cars. We will publish as many constructive comments on appearance design as we can in our "Reader to Editor" columns. Tearsheets of all published letters will be sent to all members of our panel. As for the manufacturers of the cars discussed in this survey, we have already mailed tearsheets of this article to them, inviting them to reply to the opinions expressed here. We'll publish their answers.

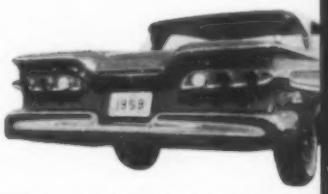
PONTIAC

KAUFMAN: **Lovely design** that looks as if hadn't been worried to bits by committee criticisms before launching . . . "nose jewel" is a small flaw.

STEVENS: With familiar basic body elements common to its cousins in the line, boasts **cleanest and most outstanding front end for '59** . . . borrows from nothing and shows the way toward dignity.

SUNDBERG-FERAR: Front end has fresh look—on the other hand, double-finned **treatment of rear fenders is plain ridiculous.**

EDSEL



KAUFMAN: Still the **most horrible design** seen on board or road.

STEVENS: Facelift of the original concept . . . **Some improvement** becauses of more orderly look and lowering of tail-light cluster.

SUNDBERG-FERAR: **Should have** tossed out the '58 design and **started over.**

RAMBLER

KAUFMAN: Many serviceable **improvements in a lummoxy shell.**

MOREHOUSE: Looks as though **one designer worked on front and another** with different tastes worked **on rear** (but then this applies to most others too).

STEVENS: **Face-lifting is hardly discernible** and exciting appearance of certain GM models may dull crusade for practical "smaller" car.

SUNDBERG-FERAR: Styling continues to be **completely unimaginative** . . . rear-fender treatment unquestionably one of worst in industry.

THUNDERBIRD

KAUFMAN: A success built by adding convenience to **beauty, and then subtracting the beauty.**

STEVENS: **Changes** in grille, side trim, etc., **are minute** and merely distinguish a '59 from a '58.

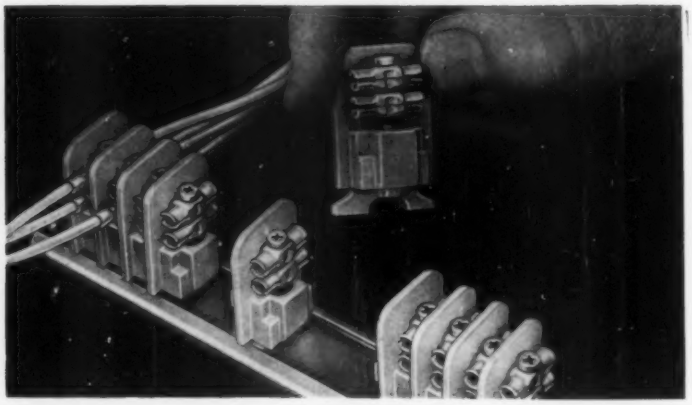
SUNDBERG-FERAR: Although '59 model is essentially same as '58, offers dramatic **evidence it is possible to achieve sleek lines, good proportions,** without resorting to tremendous length.

SIGNIFICANT COMPONENTS

Linear potentiometer . . .

mounts on piston inside hydraulic cylinder. Linearities from 0.1%, depending on stroke, and resistances from 1000 ohm are available with either center or functional taps. Produced with OD as small as ½ in., strokes from 0.100 to 8 in. **Edcliff Instruments Inc, 1711 S Mountain Ave, Monrovia, Calif.**

Circle 11, Reader Service Card



Modular terminal block . . .

accommodates wire sizes 22 to 12. Individual modules, made of low-water-absorbent nylon compound, are inserted in steel track, twisted 90° and then snapped together. End locks hold them in place. Tracks are offered in lengths to 32 in. and 30 modules mount per ft of track. Modules have 2- or 4-tier spring-loaded plated sockets that may be set for quick-disconnect. Solderless crimp-type contact tips made by this manufacturer are installed on ends of wires inserted into sockets. 1-wk delivery. **Burndy Corp, Norwalk, Conn.**

Circle 13, Reader Service Card

Disposable filter cartridge . . .

is used in air-line filter. Cartridges are self-contained cylinders made from helically-wound ribbons of phenolic resin impregnated cellulose, electrically fused together and unaffected by most liquids and gases. Air enters filter and passes through directional flow chamber that creates a cyclonic separating action within plastic bowl. Foreign matter is separated from air stream and forced to bottom of bowl, where it is trapped by brass baffle. Residue is blown out by opening blow-off valve. Air, thus cleaned, passes through filter cartridge where second cleaning process removes remaining particles. Cartridges are available in 10, 25 and 40 micron rating and can be changed without removing filter from line. Offered from stock for immediate shipment in pipe sizes ¼, ⅜, ½ and ¾ in. NPT. Filters are said to be competitively priced; filter elements are said to be inexpensive. **Perfecting Service Co, 332 Atando Ave, Charlotte, NC.**

Circle 12, Reader Service Card

Solid-state proximity switch . . .

is triggered by metal in proximity of a sensing coil. Self-contained switch is ¾ in. dia x 4 in. long. Sensing coils, bridge, transistor oscillator, two-stage transistor switch, and miniature printed circuit board are encapsulated in chrome-plated case. Potentiometer control at rear of instrument adjusts sensing zone. Switch can distinguish between magnetic and other metals, furnishes voltage steps at rates down to standstill, and requires no electrical contact with workpieces. Controls counting, routing, scheduling; can provide an alarm signal in event of shortages or stoppages; can act as noncontacting limit-switch or as overtravel alarm, feed control or indexing device. In speed-control systems, unit furnishes digital signal down to zero speed. Standard unit is $140; from stock. Delivery on custom switches, 3 wk. **Parametrics, PO Box 629, Costa Mesa, Calif.**

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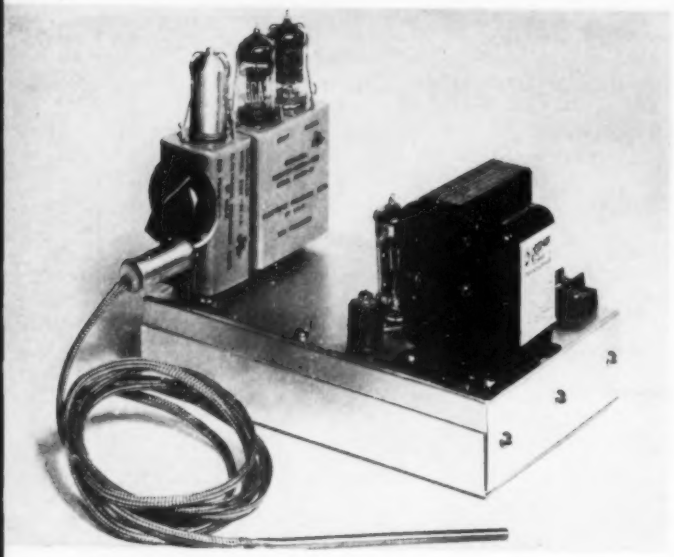
• MATERIALS • PROCESSES



Temperature control . . .

for industrial processes uses precision wire-wound or thermistor-sensing elements. Instrument continuously measures temperature and electronically compares it with set-point temperature on 0 to 100 set-point dial. Controller automatically turns heat on or off, as necessary, to maintain temperature at desired set point. Temperature differential between on and off is said to be less than 1 F. Anticipator section is available for closer control over temperatures, to ± 1 F, within temperatures of 200 to 1000 F. Standard control is within ± 3 F. Internal relay is rated 5 amp, 115 v. Modular plastic-potted electronic circuits plug in and are said to function properly even under extreme shock or vibration. Controller, with sensing element and 2-ft leads, is priced at $99; anticipator unit is $15 additional. All prices FOB San Francisco. **Electronic Processes Corp of California, 2190 Folsom St, San Francisco 10.**

Circle 15, Reader Service Card

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achieves a permanent bond when heat is applied. Transparent, non-staining adhesive is resistant to washing and dry cleaning. Supplied in liquid form to be applied by brush, roller, spray or conventional coating machine to such materials as fabric, leather, paper and plastic. Does not require heating before application. Adhesive is nonflammable. From stock. $4 per single gal; $3.25 per gal in 15-gal drums. **Adhesive Products Corp, 1600 Boone Ave, New York 60.**

Circle 16, Reader Service Card

Vinyl wrinkle finish . . .

for metals is now possible by incorporating a special compound into vinyl plastisol, organosol or solution-coating formulations. Mixtures can be sprayed and then baked to give scratch-resistant finish that also effectively disguises surface imperfections of object to be coated. $1 per lb (about 9 lb to the gal) in drums. From stock. **Union Carbide Chemicals Co, Div of Union Carbide Corp, 30 E 42nd St, New York 17.**

Circle 17, Reader Service Card

Miniature noise muffler . . .

enclosed in polyether foam in an anodized aluminum case is for use with air-operated devices. Two models protrude $\frac{3}{4}$ or 1 in., respectively, when mounted flush to $\frac{1}{8}$ or $\frac{1}{4}$-in. exhaust ports. Larger model is $1\frac{3}{4}$ in. long and fits $\frac{3}{8}$-in. port. Said to be rust-proof throughout and may be cleaned in most common solvents. Prices are $1.95 and $2.50. **Mead Specialties Co, Dept MM-44, 4114 N Knox Ave, Chicago 41.**

Circle 18, Reader Service Card

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have rated outputs of 1/45 and 1/30 hp at 10,000 rpm on continuous-duty cycle. Both types are completely cylindrical in diameter. Available sizes are $1\frac{1}{2}$ x $2\frac{7}{8}$ in. (excluding shaft) and $1\frac{1}{2}$ x $2\frac{15}{16}$ in; weights, 9 and $11\frac{1}{4}$ oz, respectively. Various armature windings are available for different voltages to provide optimum performance for particular applications. Motors may be furnished with speed governors having normal speed range between 5000 and 12,000 rpm. 6 to 8-wk delivery. **Globe Industries Inc, 1784 Stanley Ave, Dayton 4, Ohio.**

Circle 19, Reader Service Card

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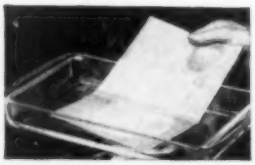

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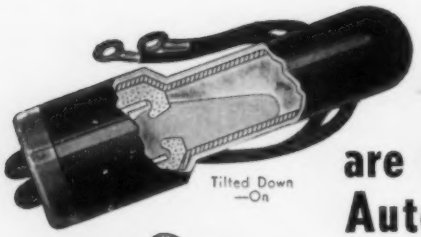

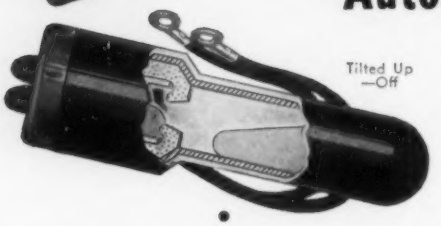

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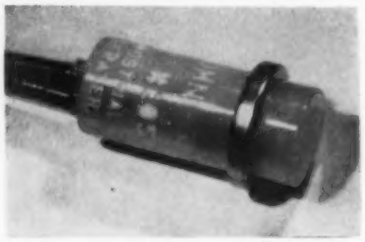
SIGNIFICANT COMPONENTS MATERIALS PROCESSES . . .



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Dallas 1 . . . R. T. Wood, 901 Vaughn Bldg., 1712 Commerce St., Riverside 7-5117

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Detroit 26 . . . P. B. Robinson, 856 Penobscot Bldg., Woodward 2-1793

Los Angeles 17 . . . Robert Obenour, 1125 West Sixth St., Madison 6-9351

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Pittsburgh 22 . . . C. F. Leveroni, 1111 Oliver Bldg., Express 1-1314

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San Francisco 4 . . . W. C. Woolston, 68 Post St., Douglas 2-4600

NEW LITERATURE

Creative Thinking

CHARLES S WHITING, *Market Planning Corp. Reinhold Publishing Corp., 430 Park Ave, New York 22. 168 pp, 5 x 7¼. $3.95.*

Creative thinking is on everyone's tongue these days, and possible techniques have been the subject of intensive research. However, studying the subject is not very productive of creativity, just as studying humor is neither very rewarding nor very productive of new jokes.

This is true of Mr. Whiting's little book. It serves a purpose in bringing together such familiar approaches to creativity as brainstorming, attribute listing and the Gordon technique. It describes each, gives its good points, argues with its critics. It also outlines the GE Creative Engineering Program, the A C Spark Plug and U S Steel approaches. It even includes suggestions for evaluating and selling ideas once they're created.

It proves again, however, at least to this reviewer, that creating ideas is an art, not a science, and that an analytical approach can perfect a net but not catch the will o' the wisp. For management men who want to try the techniques or improve the atmosphere, this is a good roundup. But it doesn't —and can't—guarantee results. For that, the essential is still the same: get and hang onto a creative man. The committee (or creative group) can refine and polish, but the new idea still comes from the mind of an individual, usually when he's alone. In creativity, as in physical height, all men are not born equal, nor do they develop equally. The best that management can do is to avoid stunting the growth.

EJT

International Conference on Scientific Information

This conference is the result of three years of preparation and planning by the American Documentation Institute (Library of Congress, Washington 25, DC), together with the National Academy of Sciences–National Research Council. None of the 75 papers presented has been published before and they have been preprinted in a 6⅝ x 3¾ x 9¾ volume of more than 1400 pp.

Papers are directed to specialists in the fields covered, with only enough background information to serve as a framework for results reported. Pertinent references are included.

Papers are divided into seven areas of discussion: (1) literature and reference needs of scientists; (2) function and effectiveness of abstracting and indexing services; (3) effectiveness of nomographs, compendia and specialized centers; (4) organization of information for storage and search—existing systems; (5) considerations in the designs of new systems; (6) possibility of developing a general theory; (7) responsibilities of government, societies, universities and industry for improved services.

GRAY IRON CASTINGS—Idea file. 26 applications of castings. Each sheet outlines a problem of design or material selection and illustrates part or product involved. Then it describes how problem was solved by using an iron casting. Available from members of Gray Iron Founders' Society. Member listing is offered by the Society, National City-E 6th Bldg, Cleveland 14.

Circle 1, Reader Service Card

MACHINING FACILITIES—File folder brochure, about 22 pp. Lists and describes tools, equipment and facilities available for contract manufacture of parts, assemblies and machines. Folder is tabbed Textile Machine Works, Reading, Penna.

Circle 2, Reader Service Card

ELI WHITNEY, MACHINE-TOOL BUILDER—Brochure, 12 pp. Biography and history of Eli Whitney and machine tools he built. Bennett Machinery Co, Allwood Rd & Route S-3, Clifton, NJ.

Circle 3, Reader Service Card

ENGINEERED SEATING—Catalog, 28 pp. Discusses and illustrates truck, tractor and earth-moving equipment seats engineered to requirements of human body. Covers standard seats, construction and specs. Pictorial story of how engineers, psychologists, anthropologists and physicians cooperate to produce seating mechanism to fit man is amplified with description of rubber torsion suspension system. Bostrom Corp, 133 W Oregon St, Milwaukee 4.

Circle 4, Reader Service Card

SPEED CONTROLLER—Catalog sheet, 2 pp. Covers function and features of pump and engine speed controller. Describes unit and discusses use. Vargo Co, 6947 Colton Blvd, Oakland 11, Calif.

Circle 5, Reader Service Card

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Publisher's Postscript...

no tariff on KNOWLEDGE

They called science the "international language"—the *only* international language. They still do.

But it isn't true and never was.

Years ago, when science was chiefly the pastime of a few highly intelligent introverts, ideas and experimental results were exchanged in letters or in the relatively exclusive society publications. A ready knowledge of Arabic, Latin, later French, German and finally English was the passport. Perhaps a half-dozen men led the work in each field. They lived everywhere but they knew each other, visited on occasion, exchanged notes on a person-to-person basis. They had a common *purpose*, not a common language.

But each man's work split and split again to make a thousand scientific directions—every one a lifetime job. We are closer to a common tongue—technical English, French and German are remarkably similar—but we lost the common purpose. Specialists understand each other, but few others can share the concepts—even if the words are familiar.

That's why today's most-sought-after man is the enlightened "generalist." He dips into many fields, many countries, and makes combinations no specialist would dream of. All the major discoveries of the past 20 years come from just such a mixture of two or more specialties. All the knowledge still to come will be carried on the shoulders of two or more scientific disciplines.

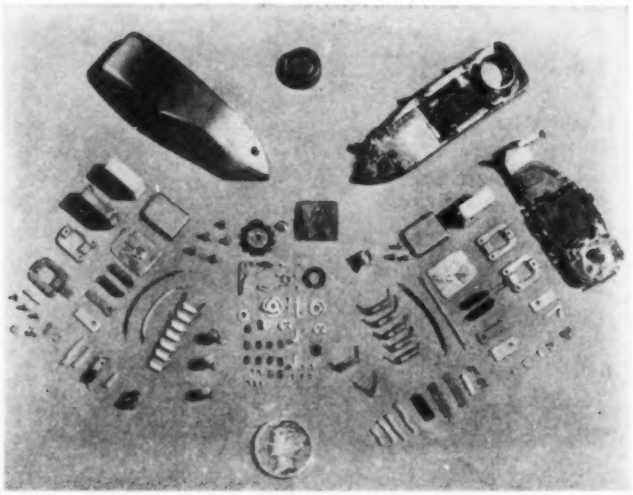
So one good measure of an engineer is the breadth of his interest, and one measure of a technical publication is the breadth of its editorial coverage.

That's why Product Engineering editors are looking over the world's shoulder. No scientific discipline is sacred. Electronics, hydraulics, plastics, metallurgy, aircraft, spaceflight, or gravity research—they all offer something to the designer, and he to them. Engineers from France, Germany, Sweden, England, Russia, Italy, Austria, even Chile, speak through our pages almost every issue.

They speak to you in English, translated and evaluated and edited by engineers. You read what is new and significant on an international scale. It competes for space and attention with a whole world full of developments to watch. We permit no import tariffs on knowledge or experience. Do you? —AH

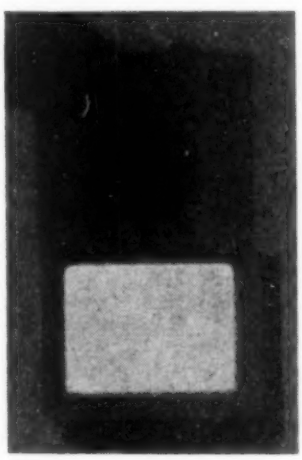
74 For Your Information (personal)

Give a listen



Hearing aids have come a long way from the horn and the big box. But apparently the end is not yet. Recent months have seen introduction of the solar-powered unit, further improvement of all-in-the-ear devices, and now automatic noise control, an extra featured in the Sonotone aid. Its parts are pictured here, above a silver dime for size comparison. Designed for use in eyeglass models, or as a self-contained behind-the-ear unit, the aid is less than 2¼ in. long, has a feedback circuit that controls the amplifying system, automatically cuts out noises above any preset level. Tiny battery (top) is one of the new midget power sources that now permit miniaturizing many types of industrial equipment (*PE—May 12, p 72*).

New light in your home



Electroluminescent night lights are being placed on the consumer market by Westinghouse, under the name "Rayescent Safety Light." Like the panels designed for industrial use (*PE—Sep 15, p 74*), these commercial plates offer long life (10,000 hours or more) and low operating cost (about a penny a year). They're equipped with standard prongs, fit flat against the electrical outlet. Dimensions are 2¾ by 2¼ in.; expected price, "about $1."

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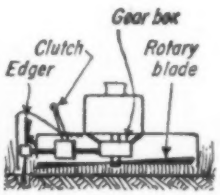
WHY DON'T THEY RESEARCH and DEVELOP...

. . . a power mower with an edging attachment. A clutch arrangement would take power from the main drive motor and run the edging blade. —A WALLBANK



. . . a magnetic or electrically charged eraser so that the small rubber and paper crumbs would either be repelled from the paper or attracted to the eraser. In this way you could brush off the erased material or pull it from the work area with a dissimilarly charged collector. —H TURENCHALK, SR.

. . . an engine-driven belt conveyor covering the cargo deck of six-passenger station wagons. With forward and reverse controls the belt would simplify loading and unloading heavy goods, such as cement and canned groceries, at the tail gate. As an added attraction the belt could be designed for rough cargo on one side and with padded upholstery on the other to make a comfortable play area for the children on long trips. —J M VASELIN

. . . some methods of draining the enormous electric potential of the upper atmosphere? Lightning and thunder demonstrate only a small part of this potential power. How about a high-altitude balloon connected by electric cable to a power station—or mountain-top towers and some means of high-voltage energy storage. —B E WILLIAMS

. . . a slide rule with thumb-rotated friction wheels to set the sliding scale and the cross hair easily and accurately. These friction wheels would normally be disengaged so that the slider could be roughly set in the usual manner. —A E NEWTON

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new addition to

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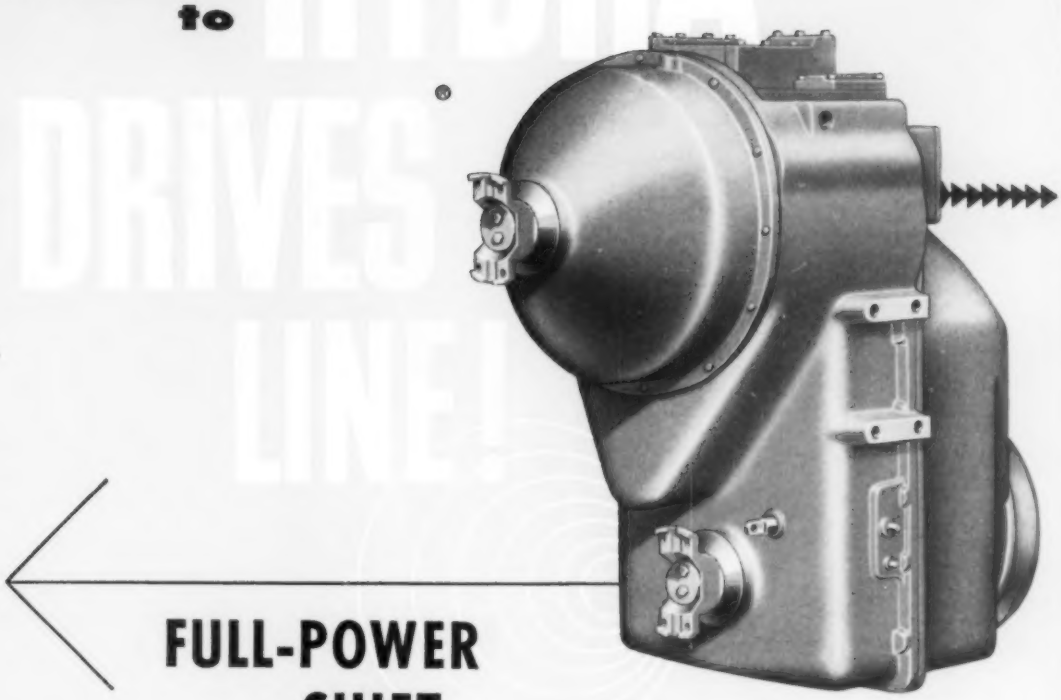

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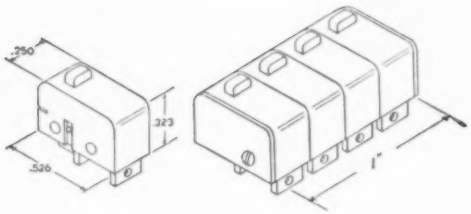

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